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Energy and deforestation in Ghana: A study of woodfuel-deforestation links in rural Ghana

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Energy and Deforestation in Ghana

A study of Woodfuel - Deforestation links in rural Ghana

by

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Abstract

Forests are one of the most valuable natural resources of many countries, including Ghana. Timber and other forest products have contributed immensely to the development of the country. These same forests have been a source of sustenance to the Ghanaian people,. Most particularly,, forests have been the principal source of domestic energy by way of providing woodfuels. The heavy reliance on forest resources is taking its toll on the health of Ghanaian forests. In recent years, there has been increased awareness of the depletion of trees - a problem that many researchers have attributed to the over-exploitation of forests especially for domestic fuel.

This thesis explores the question of the links between woodfuel use and deforestation in rural Ghana. Using two villages (Chamba and Nsuta) in the two main vegetation zones in Ghana - savannah and forests regions - as case studies, the central issues of access to, and use of wood as energy, either in the basic form, or in the processed form as charcoal and how these are linked to forest depletion and environmental degradation are explored.

Whilst factors such as high population growth rate, poverty, inappropriate agricultural policies and practices and logging are important in the debate over deforestation, the exploitation of wood for domestic energy stands out as the main destroyer of forests in Ghana. The author is of the conviction that unless immediate steps are taken to remedy the situation, Ghana, and indeed most of Sub-Sahara Africa are headed for a real environmental and energy crisis.

Based on field .esearch, the author makes some specific recommendations including the introduction and promotion of more fuel-efficient stoves, the promotion of a tree planting culture, the establishment of village woodlots, rural electrification and involving rural people in the management of established woodlots. These recommendations emphasise the protection and expansion of existing forests as against advocating the introduction of more sophisticated energy alternatives because, realistically, most rural households cannot afford these alternatives. The key, therefore, to ensuring a steady supply of household energy is to focus on protecting and expanding Ghana's forests.

Acknowledgment

I have to admit that this thesis would have been impossible without the help of others. While accepting full responsibility for the contents of this study, it is with a deep sense of gratitude that these are mentioned forthwith.

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Finally, special mention must be made of my family. My parents for sacrificing so much for me. My brothers and sisters, especially A.B Ibrahim for their support, financial and moral, and finally my wife, for being hanging in there with me, through both thick and thin.

Dedication

This work is dedicated to my family. First and foremost, to the two people who mean the world to me: My son Nana Kwame Owusu, for bringing so much joy into our life and who I miss so much. And my wife Eunice Lamisi Adam (nee Abudu). For believing in me, even during the times I doubted myself. For all her love and understanding and her constant support throughout these years. And for putting up with so much during these two years of long distance relationship.

It is also dedicated to my Parents, Maame Yaa Agyeiwaa, of Doku, Nsuta-Ashanti and Opanyin Kwadwo Duku, of Beposu-Ashanti. Even though they had the option of living a comfortable life, they decided to live without so much to see that we got what they did not have - formal education. Even without their formal education, I will need several lifetimes to learn to be **half** as knowledgeable as them. My only prayer is that they live long enough to see us make them proud.

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Chapter one

General Introduction and Literature Review

1.1 Introduction

Woodfuel, mainly firewood and its derivative, charcoal, is the principal source of energy for the majority of people in Ghana. Households use woodfuels to satisfy their domestic energy requirements, mainly for cooking and heating. The use of this fuel is, however, a source of concern not only to foresters, but also to planners and decision-makers. This is because of the perception that the use of woodfuels contributes to the loss of forests and vegetative cover in Ghana. This thesis examines the role of the production and consumption of woodfuels in the deforestation process. A comparative approach, involving the study of two villages - one in the dry savanna and the other in the moist semi-deciduous forest - is adopted to provide some basis for comparing the savanna belt with the forest region.

1.2 Human-Environment Relationship

Various opinions have been expressed on the role of humans in modifying the natural environment throughout history. One of these views was influenced by the concept of a designed earth. According to this viewpoint, the earth is a designed and purposefully-made creation by God for humans. This teleological view was deeply rooted in the Judeo-Christian traditions which saw design and order in the world and ascribed this to God. The human being was seen as a part of a larger scheme of things and a wider environment in which the human is the caretaker, a steward of God, with the task of improving the primitive nature of the earth

through tillage and in other ways, all geared toward the sustenance of humans. The basic argument of this viewpoint was that in the natural order of things, humans would use the environment, changing it for their own ends, and improving its natural state in the process (Goudie, 1987).

Another viewpoint examines the extent of human impact on the environment. This view, expressed by Simmons (1975) though it is of much older origin, contends that over time, the notion of humans subduing the earth was formulated into a philosophy of science in which knowledge and invention was combined to give humans control over nature. Humankind was considered superior to the rest of nature. Such dominance was deemed necessary in order that humans could put finishing touches to God's creation by changing its primitive conditions.

The above view was challenged by such scholars as Charles Lyell, Mary Sommerville and George Perkin Marsh. Generally, they pointed to contradictions in the above argument. They pointed out that human activities had brought about undesirable changes in nature. For instance, Sommerville reiterated the unexpected results that occur as humans dexterously avail themselves to the powers of nature to subdue nature. She emphasized that ". . . the works of the Creator are nicely balanced, and human *[sic]* cannot infringe His Laws with impunity" (cited in Goudie, 1987:3). It was, however, Marsh who presented the most eloquent chronicle of the impact of human existence upon nature. His work highlighted what he saw as the upsetting of a balance within nature by unwise human action (Udall 1962).

The above viewpoints served as the antecedents to later ideas which sought to apply the science of ecology to the study of human-environment relationships. Ecology was heavily

influenced by Darwinian thought, which included humans in the world of nature. The ecological concept proved to be attractive to scholars like H.H. Barrows and Carl Sauer. According to Stoddart (1966), from about 1910, the term "human ecology" was used to describe the study of humans and the environment and to assert the place of humans in the "web of nature." In 1923, Barrows urged geographers to make geography the science of human ecology and to view the human-environment relationship ". . . from the standpoint of humans' adjustment to the environment, rather than from that of the environmental influence" (Barrows, 1923:3). This was, in a way, a call to geographers to shift from analytic to applied research, focussed upon human adjustments to the environment (Butzer, 1989).

From the 1960s, a new research perspective - cultural ecology - evolved among geographers, especially in North America. The origin of cultural ecology is deeply rooted in the human ecology traditions and Marsh's articulation of human influences on the environment. Cultural ecology sought to understand the interrelationships between people, resources and space and it focussed on human livelihood and behavior within environmental and social constraints (Butzer, 1989). In trying to understand these interrelationships, cultural ecology draws upon interdisciplinary roots within geography and anthropology and it regards society and nature as bound together by complex interrelationships. Within the framework of these interconnections, particular attention is given to how people manage resources through the development of various strategies not only for survival but also for their development.

Although Cultural ecology was influenced by human ecology and geographical tradition, it also represents a break with that tradition. It gives prominence to cultural processes, for as Brookfield (1964) explained, the understanding of society-environment

interrelationships is next to impossible without analyzing values, beliefs and social organizations. The relationship between humans and the environment has gone through several phases over the years. This thesis draws on the analytical strengths of the discipline in explaining the complex processes of deforestation.

1.3 Background to the Study

The large scale removal of forests, especially in the tropics, has received increased international attention in recent years. The growing concern over deforestation emanates from the unique role that forests play in environmental, ecological and economic terms. The rich store of floral and faunal diversity in tropical forests, and other functions like the protection of watersheds and soils, are some of the environmental functions performed by tropical forests. The destruction of these tropical forests has resulted in such global problems as the loss of biodiversity, the depletion of the ozone layer, and local problems like soil erosion, the drying of rivers and lakes and flooding. The depletion of forests in arid and semi-arid areas is contributing to the spread of deserts, especially in Africa.

As in other parts of the world, a disturbing picture of diminishing forests has emerged in Africa in recent years. According to Grainger (1993), Africa had 703 million hectares of forests in 1980. But it is estimated that without changes to current land use patterns, the combined pressures of population growth and poverty would deplete all of these forests by the year 2000 (Myers, 1994). Deforestation is more pronounced in West Africa, where about 70 per cent of climax forests have already been lost. Deforestation in this region accounts for

over half of the rate of the deforestation on the whole of the African continent. Countries with the highest rates of deforestation are Ivory Coast and Nigeria (Myers, 1994).

Ghana is listed as one of the critical countries in which deforestation is a major problem. In fact, it ranks first in the list of countries at critical levels of deforestation as of 1980 (Grainger, 1993: 140). At the turn of this century, the forest zone of Ghana covered a third of the total land area. By 1987, however, more than 75 per cent of the land area originally covered by forests had been cleared (Forestry Department, 1987).

Extensive agricultural development and logging have largely been blamed for deforestation in the West African subregion (Grainger, 1993). Large tracts of land have been converted into farmlands by subsistence farmers, who practice various types of fallow cultivation. In addition to these small holdings, agricultural development programs embarked upon by various governments in the subregion have resulted in the destruction of vast stretches of forests. For example, all the countries in the West African subregion, with the exception of Nigeria, are dependent on the export of primary biotic commodities. As a result, the establishment of large-scale plantations have been part of their agricultural development programs. The export of primary agricultural produce like cocoa, coffee and oil palm constitute very significant proportions of total exports of countries like Ghana, Ivory Coast and Nigeria.

Logging in the subregion has also been massive because timber exports are an important source of foreign exchange for most of the countries in the subregion. In 1987, for example, Ivory Coast and Ghana were the leading African exporters of timber (Grainger, 1993). The impact of logging on forest resources of the various countries is beginning to

surface. For example the forests of Nigeria have been so overexploited that the country which used to be a major timber exporter, has now turned into an importer (GTEDB, 1993). In Ivory Coast and Ghana, the governments have recently placed bans on the export of certain species, as a response to forest depletion.

In addition to logging and agricultural development, the extraction of woodfuels, bushfires and over-grazing have been mentioned in the literature as the other causes of deforestation (Tuffour, 1989; Owusu, et al; 1989). Logging is perceived by many as the most destructive activity in the forests. People's perception of the role of logging in the deforestation process is shaped by the fact that deforestation is perceived, and largely regarded as involving the cutting of large trees only. Other causes of deforestation are not considered to be as destructive as logging. This is a rather paradoxical situation, considering the fact that the amount of wood extracted for fuel is about ten times the total annual log production (GTEDB, 1993). This paradox is partly explained by the lack of information about the impact of the everyday life and practices of people on the environment.

In light of the above, it is necessary to place more attention on the extraction of woodfuels as a primary cause of deforestation. This is because even in the absence of very reliable (scientific) studies, available evidence points to the apparent damaging relationships between the use of wood for fuel and the loss of forests (Osei, 1993). The direct and significant role of woodfuel in forest loss is suggested by recent estimates which indicate that woodfuels account for over half of all global wood harvests per annum (Myers, 1984). The role of woodfuels in forest decline is also illustrated by the fact that the highest rates of forest depletion since the 1960s have occurred in developing countries with no oil to exploit and

where there is a heavy dependence on woodfuels (Eckholm, 1976; FAO, 1981; Allen and Barnes, 1985; Postel and Heise, 1988).

1.4 The Concept of Deforestation

The term "deforestation" is not only ambiguous, there is also a lot of confusion and disagreement on what the term really means. As observed by Timberlake (1988), the term has different meanings for different people. And as mentioned by Barraclough et al (1991), although technically deforestation may denote a simple process of tree depletion, various definitions have been given to it by different people. Grainger (1993), defines deforestation as the temporary or permanent clearance of forests either for agriculture or for other purposes.

According to Reitbergen (1993), deforestation is the permanent conversion of forest land to non forest use. This is similar to the position taken by Myers (1994), who considers deforestation as the complete destruction of forest cover through clearing for agriculture and other uses. This means that not a tree remains and the land is given over to permanent non forest use.

These definitions of deforestation are compatible with FAO's definition as the complete clearing of either closed or open tree formations, and their replacement by non forest land uses (Singh, 1990). The literature shows a growing dissatisfaction with the above definitions. The main criticism is that they tend to be restrictive in their coverage or scope, disregarding other plant associations not classified as forests. But more important, as noted by (FAO, 1988), they do not consider the serious forest damage caused by excessive forest

logging, wood gathering for both domestic and commercial purposes, fires and livestock grazing as deforestation unless these result in the total destruction of the said forests or their total conversion to non forest use.

The inadequacy of the above definitions has led to a call by some researchers that the term "degradation" should be used to describe forest destruction resulting from logging, wood extraction, grazing and fires in order to differentiate it from deforestation. Grainger (1993:46-7), for instance, defines degradation as ". . . a temporary or permanent deterioration in the density or structure of vegetation cover or its species composition . . . Deforestation, in which the vegetation cover is temporarily reduced to zero, is obviously the most extreme form of degradation." A similar view is held by Paulo et al (1986:12), who define forest degradation as ". . . the elimination of a part of the woody vegetation of a given forest association, producing a forest that partially covers the site but the structure and floristic composition of which is poorer than the original one . . . But under continuous stress, caused by overgrazing or excessive firewood gathering, the degraded area may become a deforested one." Degradation therefore denotes a reduction to a lower rank, status or quality (Blaikie et al, 1993; Caswell, et al, 1973). Forest degradation is said to have occurred when there is a reduction in its structure or density or in its ability to perform all, or some of its functions.

Attempt has been made to provide a definition of deforestation that incorporates the notion of degradation. This definition considers deforestation as the degradation of "entire forest ecosystems," involving wildlife species, gene-pools, climate and biomass stocks (Myers, 1989). For purposes of clarity, however, this thesis considers deforestation as the total clearance of forests and degradation as the qualitative deterioration or the quantitative

reduction of forests, resulting from human interference, which adversely affects the ability of the said forests to perform some, or all of its functions.

1.5 Causes of Deforestation

In the literature, various reasons have been given for the massive loss of vegetative cover in developing countries. Generally, two main sets of reasons can be distinguished. The first are the immediate or proximate reasons and the other the fundamental causes (Grainger, 1993; Colchester, 1993; Brown, et al, 1994). Some of the immediate or proximate reasons frequently cited in the literature include forest clearance for agriculture, commercial extraction of timber, woodfuel extracting and mineral exploitation (Myers, 1979; Timberlake, 1988; Grainger, 1993). It is important to note, however, that behind these immediate reasons are more fundamental causes like population growth and poverty in developing countries. As noted by Colchester (1993), these fundamental causes are what set the avalanche of immediate causes in motion. It is therefore important to examine the various fundamental causes separately.

1.5.1 Population Growth

It is important to recognize the role that the rate of population growth has played and continues to play in the development effort of Sub-Saharan countries. And there continues to be heated debate about how far environmental problems can be attributed to population growth and related issues. A study by Harrison (1992, cited in Myers, 1993) concluded that population growth in developing nations is directly responsible for, among other things, 69

per cent increase in livestock numbers between 1961 and 1985, leading to desertification and deforestation and also 79 per cent of tropical deforestation between 1973 and 1983.

Deforestation in developing countries is regarded as one of the outcomes of the relationship between population growth and the environment. Scholars of deforestation contend that the addition of more numbers on earth results in the destruction of tree stocks (Vivian, 1992; Bilsbarrow, et al, 1994). The background of this perceived role of population growth in deforestation is the massive loss of forests that have occurred alongside high increases in populations in various parts of the world.

According to the World Bank (1991) and the United Nations (1992), Sub-Saharan Africa's current population of 550 million is expected to increase to 1.3 billion by the year 2025 and then quadruple or even quintuple in 150 years from now, after which it is expected that population will stabilize. The food situation is even more grim. Sub-Saharan Africa's current food deficit of 12 million tonnes per year is expected to increase to 50 million tonnes by the end of the century and then explode to 250 million tonnes by the year 2020 (Braun, et al, 1990; Pinstrup-Anderson, 1992).

As populations increase, forests have to be cleared for agriculture and also to meet the energy requirements of the people (Dewees, 1989; Colchester, 1993). Admittedly, a rise in the demand for food could be met through more efficient agricultural production. But poor economic conditions may not permit the use of such inputs as fertilizers and agricultural machinery (Grainger, 1993). Increasing food production is therefore possible in most instances through the creation of new farms and the expansion of old ones (FAO, 1988). Along with the provision of food comes the need for more wood for energy and timber. The

needs of an increasing population that results in forest loss are many and ". . . it is as if population has become a giant, a forest eating beast with an insatiable appetite, a beast that grows bigger and hungrier every day" (Awake, 1992:14).

According to Bilsbarrow and Geores (1994), although the relationship between population growth and deforestation seems obvious from the literature, the linkage between them has rarely been convincingly demonstrated for countries or for geographically significant areas. They give two reasons for this. First there is the lack of adequate and linkable data. It is not only difficult to get adequate and reliable data on population, but there is the added problem of linking demographic data with environmental data. Demographic data are usually collected on the basis of political or administrative units, whilst environmental data are often available only for areas defined by their ecological characteristics. The second problem has to do with the inherent complexity of the deforestation process, which requires the examination of other factors affecting land-use changes.

Despite these difficulties, some very good work has been done in attempting to link more convincingly, population growth and the environmental consequences. The results tend to contradict conventional wisdom that population growth in developing countries automatically brings about deforestation. Tiffen, et al in a study published in 1994, on the interaction between people and the environment over a period more than 60 years (1930 to 1990) in the Machakos district of Kenya concluded that, based on historical and other data, the district was an environmental disaster in the 1930s, with severe problems of soil erosion and deforestation. These, according to them, had been caused by agricultural cultivation, overgrazing and wood cutting. After sixty years, and a fivefold increase in the population of

the area, there has been a reversal in the area's environmental conditions. This was achieved mainly through the management practices of the small farmers, including tree planting. This study not only casts serious doubts on the legitimacy of the theory that population growth always brings about environmental degradation and deforestation, but also that environmental sustainability is, in fact, compatible with population growth.

Evidence also exists to point out that over-exploitation of resources and hence, degradation can, in fact, be associated with declining populations. In a study in the Sudanese highlands of Jebel Marra, Miehe (1989), describes a situation in which carefully managed agro-forestry has been a part of the traditional environmental management practices of the region that has helped to support a densely settled population in the past. However, as a result of a decline in the population, the resource management in the region has become less rigorous, resulting in a decrease in tree cover.

In a study in the Philippines from 1970 to 1980, Kumar and Sham (1994) revealed that factors other than population growth were more important in explaining deforestation. This is in spite of the fact that the Philippines' population growth rate at 2.6 per cent, is one of the highest in the tropics. They revealed that deforestation was a two-stepped process involving logging and agriculture. They contend that logging first converts the primary forests to secondary forests and then farming converts it to farmlands. Neither logging nor agriculture was found to be necessarily related to high population pressure.

1.5.2 Poverty

Conventional thinking about poverty and its relationship with environmental degradation posits poverty as both a cause and an effect of environmental degradation. According to the UNFPA (1991), the poor are dependent on environmental resources, such as soils, water, and vegetation for their livelihood. At the same time, poor impoverished communities are compelled by force of circumstances and conditions over which they have little control, to over-exploit their resource base.

Those who hold the above position contend that poverty forces individuals with little resources to encroach on forests (Shafik, 1994; Colchester, 1993). This argument is carried further to the national level and poverty is seen as affecting the policies of several developing countries. Indebtedness of developing countries has been blamed by some for the rapid rate of deforestation. They claim that it is a conscious decision made by the governments of these debt-ridden countries to increase logging, mining and large-scale agriculture, all in a bid to increase their foreign exchange earning to repay loans (Grainger, 1993).

There is, of course, some amount of truth in the conventional thinking that poverty leads to degradation and hence deforestation, and the literature is replete with evidence that supports this line of thinking. For example, Diegues (1992) argued that there is a direct relationship between the heavy external tax burden of Brazil and deforestation in the Amazon basin. According to him, since the 1970s, the government of Brazil has made a conscious decision that the Amazon should contribute greatly to the solution of the problem of scarce foreign exchange. It was therefore not only with government blessing, but also with

government subsidies and support from international agencies that large scale mining, logging and live stock projects were undertaken in the Amazons.

There is a section of the research community that is becoming increasingly critical of the conventional wisdom that poverty leads to degradation, and subsequently deforestation They contend that poor people can, in fact, have a sustainable relationship with their resources. They claim that the excessive demand of the western world for wood is responsible for the vast majority of degradation in the developing countries. As a result, it might be more appropriate to blame the western world for the deforestation in the developing world (Lohman, 1993; Colchester, 1993). As Lohman put it, the poverty argument is "...designed to serve the interests of political and economic elites, especially in the North. It enables the Northern interests to blame deforestation on faraway peasant groups rather than companies or agencies closer to home, and to suggest that the solution lies in the Northern wisdom and capital" (1994:27).

In support of this later position that all poverty does not mean deforestation, Broad (1994), in a study in the Philippines, found evidence that suggests that poor people can not only have a sustainable relationship with their environment, but in actual fact, they are ready to rise up to act to prevent the over-exploitation of their resources by outsiders. The literature is also full of examples of poor communities and individuals who are not only environmental sustainers, but also active protectors of their environments from degradation. The Chipko movement in India, the Naam movement in Burkina Faso and several grassroot movements across Africa, Latin America and Asia are examples of community-based environmental protection by the poor.

1.5.3 Land Tenure

Central to the issue of deforestation is the right to own and control land (Colchester, 1993). Researchers have drawn a distinction between land tenure systems in Latin America and Asia on one hand, and Africa on the other. Land tenure may therefore have different impacts on different areas (Dorner and Thiesenhusen, 1992). They found out that in Latin America and Asia, inequitable distribution of land was regarded as the root causes of deforestation.

Land tenure contributes to deforestation in two ways. First, the skewed distribution of land results in the concentration of prime arable land in the hands of small land-owning elites. This leaves the vast majority of the people landless. The landlessness and poverty facing the majority of peasants makes migration to forest frontier areas very attractive. The Brazilian situation typifies the relationship between land tenure and deforestation. Less than one per cent of the landowners possess 43 per cent of the land, while 53 per cent of the landowners, categorized as small farmers own just 2.7 per cent of the land. It is interesting to note that whilst the top 20 landowners possess about 20 million hectares, about 3.3 million farmers own 19.7 million hectares. Added to this is the fact that favored rich land owners continue to annex the lands of poor small farmers. Many of these displaced farmers migrate to the Amazon, where they contribute to the deforestation process (Monbiot, 1993). It has been estimated that, in the 1970s, there was an influx of more than 900 families into the Rondonia territory of the Amazon alone (Mahar, 1989; Mauer, 1988).

The second way land tenure contributes to deforestation is as follows: because of insecurity of land holdings, there is little or no incentive on the part of peasant farmers to

plant trees. Stonich (1989) found evidence in the Honduras that the poorest conservation practices are found among those peasant farmers with short-term contract rentals on very small plots. These were so insecure that there was no need to plant long-term trees, instead they planted annual crops even though they may occupy steep slopes.

The security of tenure has some effects on the resource base and its uses in Africa, Asia and Latin America. As pointed out by Chambers and Leach (1989), where tenure is secure, trees acquire increased importance and potential as savings and security for the poor for use to meet contingencies. They cite a study in the Kenyan district of Kakamega, in which evidence from the analysis of aerial surveys and ground control suggests that the poor substituted trees for livestock as a source of savings and as part of their long-term survival strategy. This goes to point out that where there is security of tenure, the people tend to go into more long-term ventures, which in most cases, is a pre-requisite for sustainable development.

In Africa, customary or traditional land tenure is the predominant system of land tenure. Under this system, the kinship group, rather than the individual, is the unit for defining tenure. Within the kinship group, individual and family rights depend on an elaborate system of traditions and customs (Feder and Noronha, 1987). This has led to the designation of land in Africa as a "common property". Over the years, there has been a lot of discussion in the literature over the implications of communal land ownership for resource utilization and conservation (Dornor and Thiesenhusen, 1992). One line of argument, typified by Harding's (1968) *"The Tragedy of Commons"* maintains that property held in common provides no discipline against over-use by members of the community (Dornor and Thiesenhusen, 1992).

This position has not gone without criticism. Opponents of this view contend that communities traditionally used forests sustainably in accordance with local rules and regulations that guide against over-use (Repetto, 1988; Donor and Thiesenhusen, 1992).

There is no doubt that traditional tenure has come under intense pressure in recent years. This has largely been the result of the population explosion in Africa, advances in farming technology and the emergence of markets for agricultural goods. However, development experts continue to maintain that one factor that has helped bring about changes in the traditional tenure, with implications for forest conservation, has been the management of forests by African states. Governments have taken over the authority and responsibility of maintaining forests (Repetto, 1988). In face of this weakening of traditional practices and constraints as a result of transfer of political power from traditional authorities to political appointees, there has been a reluctance, or lack of incentive, on the part of traditional communities to devise and enforce rules that ensure the sustainable use of communal resources. As mentioned by Lawry (1990: 419) "...whilst states have usurped the last vestiges of local power through legal reform, they have been unable to put in place effective alternative systems for managing collective resources".

In a study of desertification through fuelwood cutting in the Sudanese town of Bara, in the Kordofan region, Hammer (1988) reported that by an act of legislation (The Unregistered Land Act of 1970), the government claimed all unregistered lands in the country. This included lands outside village boundaries and resulted in the decline of local authority vested in the village leaders, locally known as *Sheikhs*, in controlling trees. This

usurpation of social control from traditional authority by less effective governing bodies like "peoples councils" is a very prominent feature of post-independent Africa.

1.5.4 Logging

Another issue that has been at the center of controversy as far as deforestation is concerned, is logging. Logging has variously been referred to as the destroyer of forests even though it was earlier regarded as a major contributor to economic development. Over the decades, the demand of the western world for tropical wood and wood products has been steadily rising. Many developing countries, strapped for cash and foreign exchange in their bid to accelerate the pace of economic development, have variously resorted to exploiting their forest resources to meet demand [see this as a ready source of income] (Repetto, 1988; Le Tacon and Harley, 1990). As reported by Goodland et al, (1990), these pressures on the forests have accelerated the pace of exploitation and export of forest resources from the developing countries, and as result, the WRI (World Resources Institute) ranks it as the number one agent for deforestation.

As mentioned earlier, the role of logging in the deforestation process has been at the center of debate for some time now. The question really is not whether logging contributes to deforestation - that seems to be quite obvious. Instead, the question is the extent to which the deforestation process can be blamed on logging. Barbier, et al (1994), in an attempt to establish the link between logging and deforestation, developed a statistical model using regression analysis to examine the relationship between a range of variables - timber production, agricultural yield, population density, income growth and tropical forest stock -

and forest clearance. The research, covering some 53 tropical countries, supports for the hypothesis that industrial timber production was positively associated with forest clearance in the tropics between 1980 and 1985. The authors assert, therefore, that an increase in the production of industrial timber led to an increase in the rates of forest loss during the study period.

There are others in the research community who maintain that logging has a "lesser impact" on deforestation (Grainger, 1993). Those who hold this view contend that because of the great species diversity in tropical forests, timber extraction has mainly been through selective logging, involving the removal of only the most valuable timber species (Reitbergen, 1989; Park, 1992). They therefore hold the view that in that instance the forest still remains and so "...deforestation has not occurred, but the forest has been degraded in structure and species composition" (Grainger, 1993: 70). This view has not only been criticized, but has been outrightly rejected by several researchers. For example, it has been shown that contrary to what has been asserted, selective logging turns out to be as destructive as clear field logging (Park, 1992). Jack Westoby, a former director of FAO supported this view and noted that "...massive tracts of virgin tropical forest have come under exploitation... That exploitation, with a few honorable exceptions, has been reckless, wasteful, even devastating" (1987: 264-5).

The direct impact of logging may be in dispute, but researchers do agree that logging does contribute to deforestation, by opening up forests to landless peasants, prospectors and ranchers. This is because loggers build roads to enter forests with their trucks to cart the round logs. It is these roads which are later used by others to move into the otherwise

inaccessible forest lands (Park, 1992; Colchester, 1993). As has been noted by Martin (1991), "...very selective exploitation is synonymous with very extensive exploitation and a low yield per area quickens the pace at which rain forest is opened up... And they are the beginning of the end. Logging roads are the real reason why 90% of slash-and-burn activities by immigrant farmers is concentrated in exploited areas" (189).

1.5.5 Agriculture

According to the FAO (1982), most of the deforestation in developing countries has been blamed on the conversion of forest lands to agricultural use. There is no doubt that permanent agriculture, especially cash crop production and cattle ranching have contributed heavily to tropical deforestation (Barraclough and Ghimire, 1990; Grainger, 1993). Cash crop production is expanded through the establishment of plantations. This results in the large-scale clearing of forests, resulting in deforestation and also reducing the available land for food crop production. The reduction of available land for food crop cultivation increases the tendency of subsistence farmers to encroach on forest lands. In Latin America, cattle ranches established to increase the commercial production of beef have led to the direct clearance of large tracts of forests (Hecht, 1983).

The slash-and-burn farming system has received its share of the blame for deforestation in developing countries. Under various names, such as bush fallow system and swidden farming, the system refers to the type of agriculture in which a piece of land is farmed for a few years, then abandoned to enable it regain its lost fertility (Dickson and Benneh, 1988; Enquete Commission, 1992). With this system, most of the trees and other

woody vegetation are usually cleared from the area intended for farming. These are gathered into heaps, left to dry in the sun and later burned. In the process, however, commercially valuable trees, and trees too big to be handled by available tools are left standing on the farm and might help to provide some shade during the farming season. Ashes from the burning, rich in potash and other minerals, help to improve the fertility of the soils. The area is farmed for a couple of years or more until yields begin to decline due to fertility loss, after which the plot of land is abandoned for a fallow period, the length of which depends on the pressure on land. Even though individual farming families work only small tracts of land at a time due to the limitations imposed by the tools used (axes, hoes, cutlasses, etc), the cumulative effect of the large number of shifting cultivators is very devastating (Park, 1992).

Researchers, such as Park, have actually referred to shifting cultivation as the most important cause of forest depletion and maintain that available evidence suggests that "...forest clearance for agriculture far outstrips other causes" (1992:47). Not all researchers, however, accept this blanket assertion. One of them, Grainger (1993), for example, asserted that the long fallow periods between successive cropping seasons allows fallow lands to rejuvenate and to regain their fertility. This rejuvenated vegetation, he maintains, helps to protect the soil and prevent soil erosion. To those who hold this view, therefore, shifting cultivation poses very little threat to the integrity of forested lands.

This view may be true of some cases, especially under low populations, where the system can, in fact, be sustainable and can help in the intricate dynamics of forest ecological systems. However, under conditions of intense population pressure on land, the basis of

sustainability can be undermined. Reduced and inadequate fallow periods as a result of the pressure on land allows little time for rejuvenation and the natural regeneration of forests.

1.5.6 Climatic Changes

There is a school of thought that has put forward models to explain environmental degradation to have been caused by climatic change. Examples of such models include the Explanatory Model for increased drought and accelerated desertification in the Sahelian regions of Sub-Saharan Africa (Charney, 1975). Sub-Saharan Africa is one of the regions of the world with the least predictable climatic conditions. Drought on the continent is a constant feature. Climatic drought is referred to as subnormal rainfall (I. U. C. N., 1986). The continent has experienced some very severe droughts, especially in the Sahel regions over the century, notably since the 1950s. The 1970s and 80s droughts were by far the most severe.

There is some disagreement concerning the role that drought and other climatic phenomena play in the debate over the causes of degradation and eventual deforestation. Whereas some people have the view that climatic changes are the principal causes of environmental degradation, others hold that human factors are the main causes. But on the whole, it can be said that drought as a relative concept implying rainfall insufficient to support human and animal populations [at current levels and current systems of management] has "revealed, not caused ecological imbalance, environmental degradation and mismanagement" (I. U. C. N., 1986).

The above review of the literature has shown that the causes of environmental degradation and deforestation are very complex. The animal carrying capacity of the land is

rather inflexible. The carrying capacity of the land for humans depends on several factors which include the type of exploitation, inputs, technology, ecological change, social issues and cultural issues of the perceptions of what ecological change is acceptable (I. U. C. N., 1986).

Looking at the myriad of opinions expressed by the various researchers above, whatever conclusion one draws from the above opinions on the causes of deforestation, it all points to the complicated and complex nature of one of the most intractable problems facing the developing world. There is no doubt also that not any one of the above reasons - logging, agriculture, population and poverty - can be deemed to be exclusively responsible for deforestation. Instead, a complex combination in varying degrees of importance, depending on the area, helps to trigger off a chain of reactions, starting first with degradation and finally resulting in deforestation. In the debate about environmental degradation and deforestation, it is particularly important to examine the role that woodfuel plays. The next section is devoted to examining energy sources in developing countries. This helps to highlight the problem of woodfuel extraction - the focus of this thesis.

1.6 Energy Sources in Developing Countries

There are two distinct groups of energy consumers in the developing countries, using energy sources and needs as the basis for classification, according to the US Congress (1992). The first group, those with access to modern commercial fuels like petroleum, coal, natural gas and electricity, live mainly in the urban areas, with sizable fuel distribution systems. Rural dwellers make up the second group, with a heavy reliance on traditional fuels like woodfuels,

crop residue and other sources like animal dung. This group is typified by subsistence economy with little or no access to modern fuels.

Using oil, the most consumed commercial fuel in the developing world, as a basis, the WRI (1994) has also classified the developing world into two groups - oil exporting and oil importing nations, according to their source of oil. About twenty-six countries, mainly in the Middle-East, accounting for about 23 per cent of global oil production make up the oil exporting countries in the developing countries. On the other hand are the other countries in the developing world which are not so well endowed with oil resources, and which rely on importation in varying degrees to meet their energy needs. This dependence on oil by the oil importing countries has very serious implications for the balance of payment positions of these countries, because they siphon off very high percentages of their foreign exchange earnings to finance these purchases. It should be mentioned, however, that about half of the developing countries have recoverable oil reserves (Johnson, et al 1993). The lack of capital and the technological know-how has also effectively prevented the development of very viable alternatives like hydro-electricity. As a result of this, very little of the developing world's potential coal and renewable energy resources like hydro-, wind-, solar- and nuclear-power have been tapped (Moriera and Poole, 1993).

It has been estimated by the WRI (1994) that even though the developing world produces about 50 per cent of global energy and accounts for about 75 per cent of the world's population, developing countries consume only about 30 per cent of total global energy budget. Breaking this up, this consumption comprises 26 per cent of all commercial

energy and about 85 per cent of all domestic fuels. They also assert that biomass alone accounts for one-third of the energy needs of developing countries.

According to Goldemberg et al (1988), differences in energy consumption levels between developed and developing countries are more pronounced at the individual level. They estimated that per capita consumption of energy in the developing world, including both traditional and commercial fuels[1], is less than one-sixth of that of the developed world. All this is in spite of the fact that per capita consumption of energy in the developing world had increased about seven-fold faster than in the developed world over the past two decades. Levine et al (1991) attributed this rapid increase in energy consumption in the developing world to rapidly expanding economies, rising populations and increasing urbanization. However, as observed by Goldemberg (1991), the benefits of this increase have not been enjoyed by the majority of people in the developing world, for "...in spite of this growth in consumption, energy services in developing countries are scarce for all but the wealthy minority" (111).

Due to the high cost of commercial energy and scarcity in developing countries, the use of commercial energy is outside the reach of the vast majority of the people in the developing world. As a result, there has been a lot of pressure on traditional fuels. According to Awake (1992), about three out of every four people in the developing world depends on wood as a source of energy for cooking and heating. Due to increasing populations which are creating chronic shortages of traditional fuels, a legacy of environmental degradation and

[1]Traditional fuels here refer to biomass related fuels, mainly woodfuels, and others like animal dung and crop residue. Commercial fuels, on the other and, refers to hydro-electricity and other petroleum fuels and LPG

declining soil fertility is emerging in the developing world. It has been observed by various researchers that fuelwood is fast disappearing in the developing world and some even estimate it to be at a crisis point. Awake (1992) asserts that about a billion people are at the risk of not being able to satisfy their energy needs. Scarcity of firewood in various countries in the developing world is responsible for more and more people burning crop residues and animal dung for energy (Raddy, 1992; Liu et al, 1992).

1.6.1 Energy Efficiency - The Firewood/Charcoal Controversy

There has been a lot of discussion on the efficiency of charcoal as an energy source, compared to firewood. One view is that in the conversion of wood to charcoal, there is a loss of 60 per cent or more of the energy contained in the original wood. This has led to widespread condemnation that charcoal burning and use causes an excessive burden on the country's wood resources. They therefore call for the use of unprocessed wood in order to reduce the amount of wood mass used and consequently the rate of depletion (Foley, 1986).

This idea has been vigorously challenged on the grounds that since the conversion of wood into charcoal being endothermic, charcoal actually absorbs more energy than it releases in the process of conversion. An added advantage of charcoal over raw wood is the relative ease with which it can be transported (F.A.O., 1983).

1.6.2 Linking Woodfuel and Deforestation

The literature suggests that excessive exploitation of forest for wood as a source of energy is responsible, to a large extent, for deforestation in the tropics (Barraclough and

Ghimire, 1990; Bowonder, 1986). The FAO (1986) even suggests that about 2 billion people worldwide rely on woodfuel and according to Le Tacon and Harley (1990) about 80 per cent of all the wood harvested in the Tropics is burnt as fuel. Widespread forest depletion, coupled with the dependence on wood and the resultant increasing difficulty in finding wood for fuel has been used by some as indicators of deforestation. This was the prime motivation for Eckholm referring to the situation as "*The Other Energy Crisis*" (1975; Köhlin, 1993), referring to the massive loss of trees in the early and mid-seventies.

According to Parker (1992), the negative effects of deforestation are directly related to population pressure. Researchers agree that "...in so far as deforestation is the result of woodfuel needs, it springs from urban, not rural needs. Rural people are in general sufficiently scattered through the landscape for their needs to be met in perpetuity from the mean annual increment of even unproductive bushland. Only when they and others begin to collect for the far greater and more concentrated needs of urban markets do open areas of bushland begin to be cut to extinction" (Shepherd, 1991). A similar view by Mather (1987), noted that urban growth is making the problem of supplying and cutting woodfuel very difficult by concentrating demand and thus causing extreme pressure of demand on local woodfuel resources, results in the excessive removal of trees in the surrounding area.

Whitney (1987), mentioned the differential impact of woodfuel use in rural and urban Sudan. He noted that household energy use is a major source of deforestation in Sudan. For example, between 1960 and 1980, the amount of deforestation attributed to household woodfuel consumption was estimated to have risen from nearly 7,500 sq. kms per year to 28,000 sq.kms. per year. During the same period, the average annual rate of deforestation was

1, 033 sq. kms. According to Leach et al (1993), many surveys have been conducted which all confirm that the bulk of the firewood consumed by rural dwellers is made up of twigs and dead branches, which are non-destructive. Similar observations were made by Osei (1993) in his research on fuel use and its impact on forest ecosystems in the Eastern Region of Ghana. He concluded, among other things, that the dwellers in the study villages did not make direct use of live trees in the forest as sources of woodfuels, instead, they used trees, which died either through natural means or as part of the farming process.

The above view contrasts sharply with that expressed by Kalapula with respect to Zambia (1989), that an estimated 8.2 million bags of charcoal are delivered to markets in Lusaka and the Central Copperbelt Provinces. About 64 per cent of the clearance of forest lands within 50 kilometers of the city of Lusaka is attributed to demand for woodfuel in Lusaka. He estimates that forest clearance is taking place at the rate of 1,150 hectares per annum, and for the Copperbelt, felling for woodfuel removes 11,000 to 13, 800 hectares of timber every year. In 1980, for instance, it was reported that 369 million bags of charcoal were consumed representing 19, 400 hectares of woodland.

1.7 Models on the Relationship Between Woodfuel Use and Deforestation

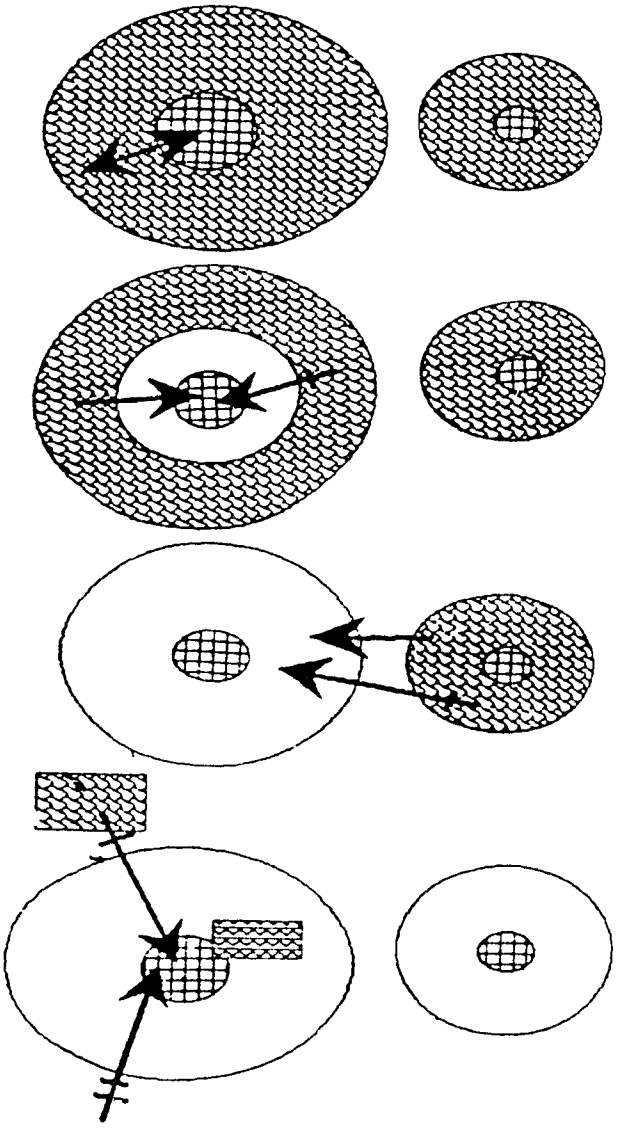
From the literature above, it can be concluded that there is no doubt woodfuel use results in patterns of deforestation. In a bid to better understand the situation, the evolution and organization of such patterns have been conceptualized in the development of models. One such model was developed by Digernes in 1979. The model Digernes developed was for fuelwood supply for domestic use in dryland population centers, using her studies in the

Sudan as the basis. Digernes noted that the worldwide interest in, and concern for desertification was highlighted in the 1970s, as a result of the sufferings caused by a long period of drought in the Sahel. This concern culminated in the holding of the UN conference on Desertification in Nairobi, in 1977. Among other things, the conference concluded that "...human pressure on fragile ecosystems in adverse climate conditions is the most important factor in desertification" (UNCOD, 1977). According to Digernes, "...the main human-enforced factors leading to the severe deforestation, erosion and soil deterioration in the Sahel zone are overcultivation, and overcutting of vegetation for fuel" (1979:1).

To study the extent of environmental degradation attributable to woodfuel, Digernes estimated the amount of woodfuel consumed and looked at their impacts on vegetation cover and regeneration ratios in the Bara region. She revealed that over a period of ten years, there have been significant changes in the consumption of firewood and charcoal. These were represented in her model (figure 1.1).

These changes include shifting first from meeting local energy needs from local sources of firewood by the users themselves, to meeting local needs from distant parts of the town's perimeter. With time, and with the exhaustion of supplies from this source, professionals resort to bringing in firewood from other population centers. At this stage, the settlement completely relies on the importation of firewood supplies to meet local demand for fuel. Added to that, alternative energy sources are imported. The final stage in Digernes' model is when professionals bring in charcoal from fuel producing forest reserves. At this stage, there is an increase in the use of external alternative energy sources. There is also the production of local alternative energy supplies.

Figure 1.1 Model for fuel supply around population centers



A Wood obtained by users from the field

B. Wood and charcoal supplied by professionals from distant parts of the center perimeter

C. Professionals provide wood and charcoal from other population centers. Alternative energy sources are imported The center is totally dependent on external energy

D. Professionals bring charcoal from fuel producing forest reserves. The amount of external alternative energy sources increase. Alternative energy is produced locally.

Desertified area

Settlement

Forest and fields

Alternative External fuels

Charcoal

Wood

Alternative Internal Fuels

Source: Based on Digernes (1979)

A second model, developed by Whitney (1987), holds the view that the consumption of fuelwood is the major cause of deforestation in the Sudan. He noted that the annual rate of removal exceeds the "allowable cuts", meaning the amount of wood that can be harvested on a sustained-yield basis yearly. It was this imbalance, in his opinion, which caused deforestation. He also noted that deforestation did not occur in a uniform manner in the whole country. In his opinion, the theories of von Thünen and August Lösch best explained their distinct patterns. For both theories, the basic underlying premise is that the type and intensity of economic activity is greatly influenced by its location in respect to the market.

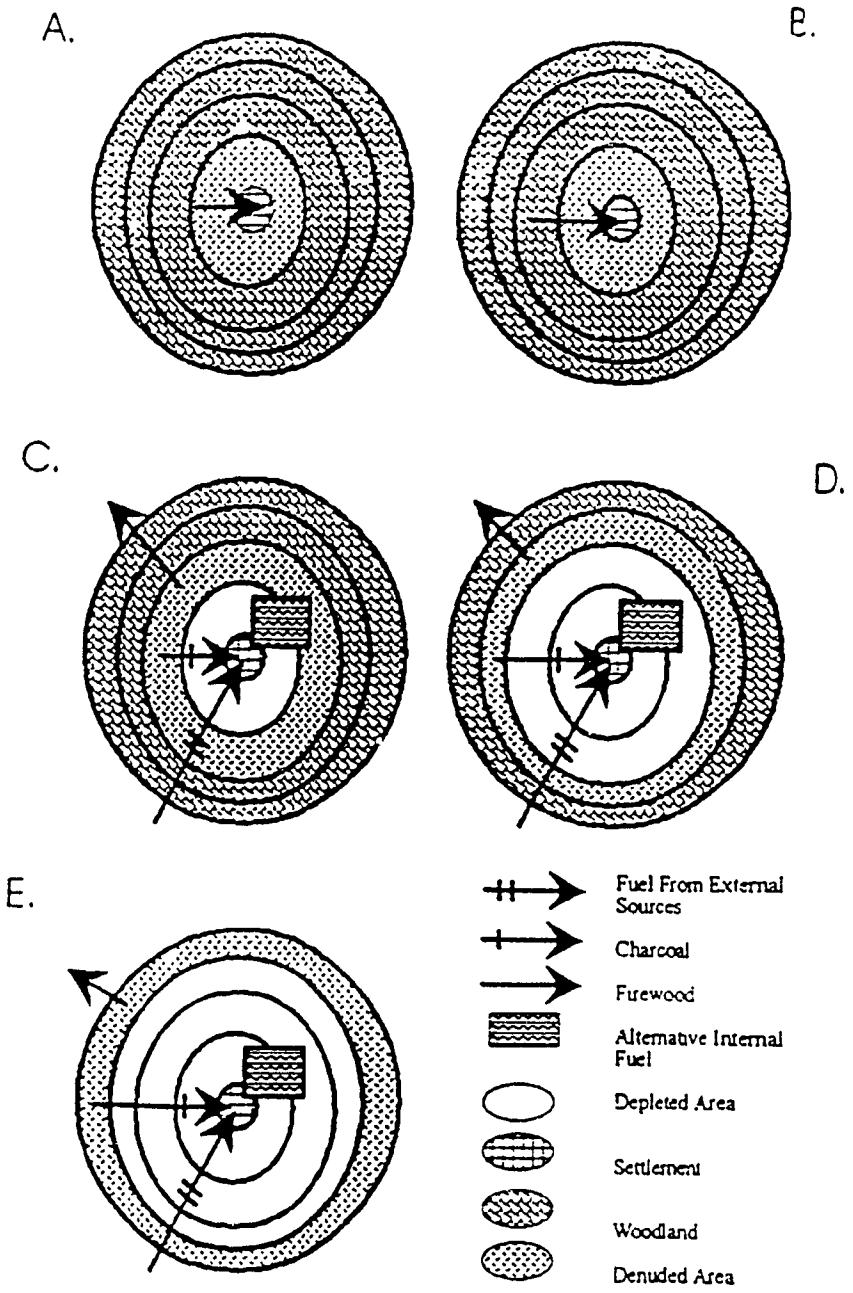
Increases in the distance from the market brings the profitability of the product towards zero. When profitability reaches zero, production is stopped. With the assumption that there is a perfect homogenous environment with equal access to all points, a concentric pattern would emerge as far as the spatial organization of economic activities are concerned. However, in reality, there are variations in resource distribution and accessibility to markets. These prevent the realization of the theoretical patterns.

According to Whitney, in subsistence fuel gathering, collection and distribution decisions are not expressed in monetary terms but in terms of effort and time expended in the activity. In labour redundant situations, in which there is no opportunity cost, much greater effort is expended on fuel gathering, with the resultant deforestation. In this situation, there would continue to be fuel gathering until the effort expended in collecting and transporting the next unit of wood exceeds the effort of moving to a distance, but more wooded area. The implication of this is that the zone of intense fuel-gathering will gradually move away from the center leaving behind an area where most of the vegetation has been collected for fuel. On

the other hand, in labour employed situations (where there is no redundant labour), meaning a high opportunity cost, the destruction of woodlands is minimized since subsistence fuel production is easily replaced by commercial firewood and charcoal supplies from distant production centres. With a descriptive model, Whitney presented the sequence of fuel gathering and their environmental consequences as they occur during the development of a population center (figure 1.2). This model, which involves stages representing increasing size and attendant demand of urban centers, denotes the varying intensities of fuel-gathering activities located at different distances from an urban center. In the first stage of his model, Whitney notes that tree stock in the immediate vicinity of the settlement is depleted as a result of the gathering of certain preferred species of dead wood by women and children, the clearance of land for agriculture and overgrazing, with little or no gathering of wood further away from the settlement.

In the stage two, the first area is devoid of any of the preferred species, thus concentrating fuel-gathering and transportation in the next circle. Women and children on foot are constrained by distance, resulting in the use of donkeys and camels and other beasts of burden in transporting fuel. In minimizing effort, the inner circle nearest to the settlement is depleted more quickly than is replaced naturally, thus resulting in the destroying of all the trees in the area. The next circle is characterized by serious denudation and soil erosion in the first circle, and all gathering is done in the second circle area. There is also a shift from bulkier firewood to charcoal, which is lighter. Alternative supply sources are also sought. The final two stages of the model are a progression of the trend, with denudation and erosion increasing in proximity to the settlement.

Figure 1.2 Model of deforestation around settlements



Source: Whitney (1987)

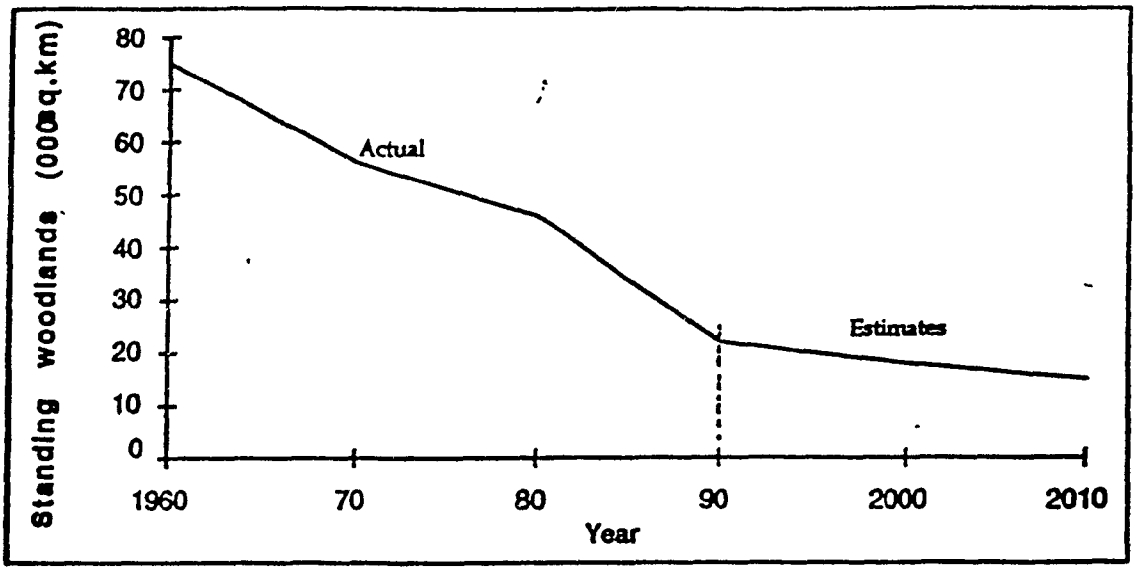
The above two models were developed with research in the Sudan. But that does not limit their usefulness in helping us understand the woodfuel problem better. Later on in the thesis, an attempt will be made to relate them to the findings in the study area, in order to find out how this explains the woodfuel situation in the areas under study in this thesis.

1.8 Statement of the Problem

Ghana is a predominantly rural country, with more than 70 per cent of the people living in rural areas (Obeng, 1990). Firewood is the major source of fuel for rural dwellers and charcoal constitutes the predominant domestic fuel for 69 per cent of urban households (Nketia, et al, 1988). About 95 per cent of households, both rural and urban, rely on woodfuels for cooking (EPC, 1989). It is estimated that in 1985, 12 million cubic meters of woodfuel, accounting for 70 per cent of the country's total energy usage, was consumed (IUCN, 1988).

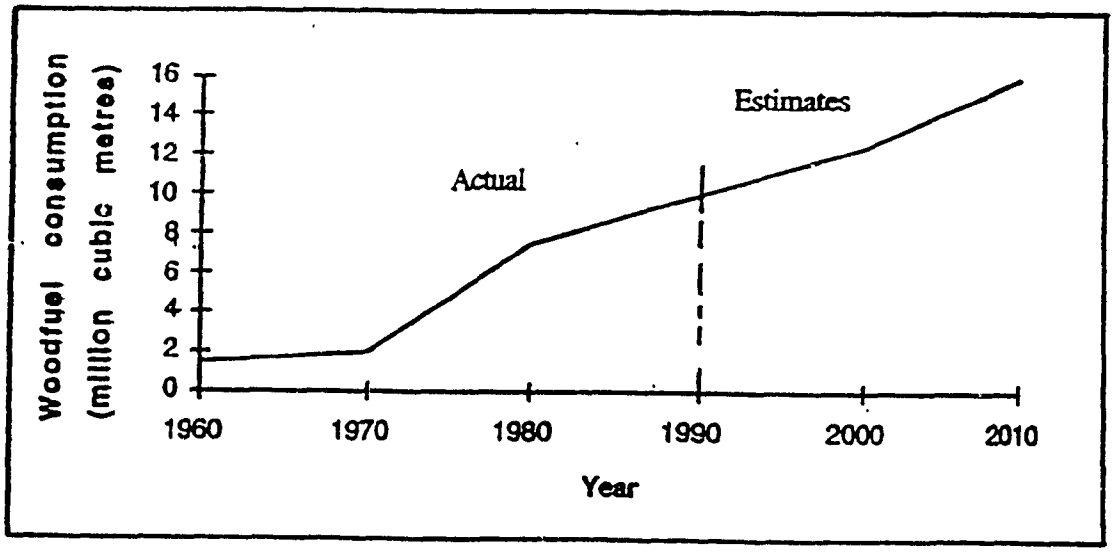
Various governments have at, one time or another, tried to deal with the problem of overreliance on woodfuels. In spite of these efforts to reduce the consumption of woodfuel in order to reduce the pressure on forest resources, the consumption of woodfuel has been increasing, rather than decreasing. The per capita use of woodfuel, which is already one of the highest in the world, is increasing and it is projected that the annual requirements will rise to about 17 million cubic meters by the year 2000. As a consequence, the wood that would be extracted will exceed the annual increment of trees (IUCN, 1988). The acuteness of the situation is illustrated by Tuffuoh, (1989), who posited that whereas woodfuel consumption is sharply increasing, standing woodland is fast declining (figures 1.3 and 1.4).

Figure 1.3 Estimated woodstands in Ghana by the year 2010



Source: Tuffuoh (1989)

Figure 1.4 Estimated woodfuel consumption levels by the year 2010



Source: Tuffuoh (1989)

The increase in the use of woodfuel is taking place in certain areas in spite of the availability of alternative sources of energy such as electricity, kerosene and liquefied petroleum gas (LPG). Although a shift from the consumption of woodfuel to these alternatives could relieve the pressure on forest resources, these alternatives form an insignificant proportion of current domestic energy consumption, especially in rural Ghana. The high prices of these fuels, and the cooking devices and equipment required, have made their use unattractive and beyond the means of the majority of the people. Firewood and charcoal therefore, remain the most preferred fuels.

According to Nkum and Wireko Brobbey (1989), the ability of the Ghanaian forests to provide sufficient wood to meet the requirements of a rapidly growing and urbanizing population is seriously in question. Ghana's population has been growing at an annual rate of about 3.2 per cent since 1980 (World Bank, 1991) and it is estimated that woodfuel consumption trends will be along similar lines (Chachu, 1993; UNDP/World Bank, 1986). Increase in population is also accompanied by an increase in the process of urbanization. Since 1948, there has been a dramatic increase in the urbanization process. For example, the urban population in Ghana has increased from 12.8 per cent in 1948 to 32 per cent (CBS, 1970; 1984), leading to the commercialization of woodfuels.

The increased demand and commercialization of woodfuel in the urban areas as well as the dependence on wood resources in rural areas, have very obvious effects on rural environments. Because of high prices of firewood and charcoal, induced by shortages in urban areas, rural dwellers are cutting down trees, frequently live ones, in the countryside and selling the to urban dwellers as fuel (EPC, 1991).

Firewood and charcoal are the main domestic fuels for most of the households in rural Ashanti and Northern Regions (figure 2.1). Rural dwellers in these regions have also been important suppliers of both firewood and charcoal for the urban areas not only in the two respective regions, but for the urban households of most of the southern regions of Greater Accra, Western, Eastern and Central as well.

1.9 Purpose of the Study

The literature supports a strong linkage between woodfuel use and deforestation. Based on the assumption, therefore, that increasing demand for woodfuels is having an increasing negative impact on the environment by way of environmental degradation and deforestation, the purpose of this study is to investigate those factors associated with woodfuel use and deforestation in Ghana.

1.10 Objectives of the Study

In order to achieve the above purpose, the following specific objectives are set for the study:

1. To investigate the factors that influence the demand for fuelwood in rural Ghana. In connection with this, options of energy supply available to rural people will be examined as well as barriers that hinder the use of alternative energy sources.
2. To investigate the role of traditional gatherers and traditional authorities and changes that have taken, or are taking place. To achieve this, issues of who in the family is responsible for collection of firewood, the role of women and children as well as

reasons why changes are taking place, if any, will be examined. The diminishing importance of traditional authorities as guardians of the environment will also be investigated.

3. To investigate the perception of forest depletion by rural people and the causal relationship between wood scarcity and deforestation. Local and community efforts aimed at halting the process of deforestation will be investigated.

4. Finally, recommendations will be made to minimize the effects on the environment based on the evaluation of the field data.

1.10 Significance of the Study

First and foremost, the significance of the study derives from its investigation into an environmental problem that is potentially dangerous in an already fragile environment. The Ashanti region is in the forest region of Ghana, with its northern fringes in the transitional zone between the forest and the savanna zones. The region is therefore fragile and the encroachment of the savannah is real. The Northern region on the other hand is in the fragile savannah zone and in recent years it has been under attack by the encroaching Sahara desert. The two selected villages therefore provide a very good basis for comparison to assess the overall woodfuel and deforestation situation in Ghana. It is imperative that studies are conducted into all human activities that tend to have negative impacts on the forest resources of the country. Studies such as this one are important because they can provide information and data that can form a reliable data base on which energy planners, foresters, and policy-

makers in the country could base their strategies for resolution of the country's environmental problems.

Another significance of the study derives from its focus on the linkages between energy production/consumption and environment. The recognition of this linkage is very important to Ghana's drive toward achieving sustainable development and a sustainable future. Energy and environment are two important facets of every modern economy, and by focussing on the linkages between them, an opportunity is provided for an integrated and systemic approach to both energy and environmental planning in the country.

The lack of reliable and comprehensive data and information is one of the major constraints on planning and attempts at devising solutions for problems in many less developed countries. This is even more pronounced in environmental problems because of the complexity of the problems. Information from this study can provide some of the data base for more effective planning.

1.11 Summary

This review of the literature reveals the confusion surrounding the term "deforestation". The confusion does not only involve what the term entails, but also the causes. The lack of consensus does not, however, mean that there is a lack of expression of views. A diversity of views has been expressed on the issue of deforestation and these views have "...frequently been blundering and over-passionate with the result that the debate has become confused and there is a risk of jeopardizing the success of the crusade" (Lanly, 1982, in Timberlake, 1988). It is important to note that the efforts to reduce deforestation in

developing countries have a better chance of success if as much attention is given to environmental degradation as deforestation. This was the prime motivation in seeking to separate degradation from deforestation.

There is no doubt that deforestation is a very complex phenomenon that requires global perspectives for understanding. However, being an environmental phenomenon and an infinitely complicated issue, it makes such a global perspective almost impossible. Various studies have therefore been done at the local level in different parts of the world. In their own ways, the individual cases have shown the role played by individual causes. Some of these studies seem to contradict others done elsewhere. But taken as a whole, these individual case studies could be the foundation for the formulation of more universal theories and models. Researchers seem to agree on the role of woodfuel in the deforestation process, even though there seems to be some disagreement on the extent of that role.

Generally, however, there is agreement from the studies reviewed above that firewood and charcoal use have a negative impact on forests. In spite of this observation, however, woodfuel continues to be the main fuel for the majority of the people in the developing world. Forecasts into the future do not paint a different picture either. The developing world has been shown to abound in alternative fuel sources. These include huge potentials in hydro-electricity, solar and wind energy and petroleum. The use of these could greatly relieve the pressure on forests in developing countries. The problem, as pointed out in the literature, is mainly the lack of capital and technological know-how. The future of most of the countries in the developing world, especially in Sub-Saharan Africa, does not look bright as far as making the shift from woodfuels to alternative energy sources is concerned. There is therefore

the need to look at ways to make woodfuel harvesting more sustainable, even as we struggle to find ways of switching to alternative sources of energy.

The next chapter examines Ghana's energy situation and the role of woodfuels in meeting Ghana's rural household energy requirements.

Chapter Two

Ghana's Energy Situation

2.1 Introduction

Energy has been defined as the capacity to do work (Johnson et al, 1994) and the type of energy used by any society is generally an indication of the level of economic development of that society. Research indicates that the principal source of fuel for three quarters of the people of the developing world is wood, and wood dependence is highest in Africa. It has also been established that the extent of forests has been declining at a rapid rate, especially since the 1960s, in areas of heavy dependence on wood for fuel. These are mainly developing, non oil exporting countries, of which Ghana is one (Eckholm, 1976; IUCN, 1980; Allen et al, 1985). It is important to note, however, that for many countries in the developing world, "woodfuel constitutes the cheapest and most accessible source of household fuel for the majority of the population, especially those living in rural areas" (Osei, 1993).

This chapter examines the types of energy used in both rural and urban Ghana. The chapter examines the use of both imported and local energy sources. It considers the domestic, commercial and industrial preferences of energy in Ghana. Emphasis is placed on woodfuels since it is not only the principal source of energy for the majority of people in the developing world, but also the energy source with direct links to deforestation

Taking the case of Ghana as an example, it can be seen (Table 3.1) that fuelwood, comprising firewood and charcoal, are the principal source of energy not only for rural Ghana but for urban populations as well. As can be seen from the table, Ghana depends on

three major sources of energy for domestic uses. These are fossil fuels (liquefied petroleum gas or LPG and petroleum products), hydroelectricity, and woodfuel. Missing from the table are the figures for solar energy use. By far the most important source is woodfuel. As Ghana's population grows at an annual rate of 2.6 per cent (Dadson, 1988), demand for energy will continue to increase.

Table 2.1 Household energy usage in Ghana

Fuel Type	Urban %	Rural %	National Average %
Charcoal	68.8	10.5	39.65
Firewood	16.8	76.2	46.5
Kerosene	5.9	6.4	6.15
Gas	4.6	0.3	2.45
Electricity	2.6	0.1	1.35
Stubbles	1.2	6.5	3.85
Total	**100**	**100**	**100**

Sources: 1. Nketia et al (1988)
2. Ghana Energy Commission (1990)

2.2 Energy Supplies and Demand

2.2.1 Petroleum

Ghana is known to have commercial quantities of oil deposits. For some time now, offshore exploration has been taking place around Saltpond, in the Central Region. It has been the hope of the government that the extraction of these reserves will prove to be profitable. In the meantime, the country has to depend on importing oil to meet domestic

needs. In 1990, the country produced a little more than 27000 barrels a day, accounting for only 10 per cent of total daily consumption in the country (Ghana Energy Commission, 1990). The country currently imports petroleum from Nigeria, Algeria and the North Sea. The Ghana National Petroleum Corporation (GNPC) is the government agency responsible for the importation of crude oil into Ghana. Of the total national imports estimated at $1,661.4 million in 1993, oil imports accounted for $165.2 million (Minister of Finance, in Daily Graphic, 1994).

Oil has been one of the main drains on the country's coffers. In 1991, imported oil made up about 13 per cent of the total national energy consumption (EPC, 1991). Over the years, fluctuation in the price of oil in the international market has posed one of the most critical budgetary concerns to the national treasury. Especially in the 1970s, in the wake of the oil crisis, the government began massive subsidies to make petroleum fuels affordable to the people of Ghana. The dependence of Ghana and indeed most developing countries and their vulnerability to unstable world oil prices was observed by Morgan et al (1981, 8) "despite their lesser importance in the oil trade, these countries have become even more dependent than more developed countries and in consequence are economically and politically vulnerable."

According to the Statistical Service of Ghana (1990), from 1973 to 1978, and from 1981 to 1986, state subsidies on oil imports alone represented 10 per cent of the national budget, amounting to an annual average of more than 380 million dollars in the 1970s and more than 500 million dollars in the 1980s. These accounted for nearly 35 per cent of all imports and more than 50 per cent of all export earnings. Of these subsidies, 8

per cent went to subsidize kerosene, the most used commercial type fuel in the rural areas. Since 1986, however, the government, as part of the I.M.F. sponsored structural adjustment policies (SAPs), has removed more than 80 per cent of these subsidies (GMFP 1990).

The types of petroleum products used in Ghana include petrol, diesel, kerosene, liquefied petroleum gas and lubricants. Lubricants, petrol and diesel are mainly used in the transport and industrial sectors. Domestically, however, the most important petroleum fuel in Ghana is kerosene which is used for lighting. The vast majority of rural areas use kerosene as fuel in lamps, commonly known as hurricane lanterns, for lighting their homes. It is also used by some urban homes for cooking, using kerosene stoves. These are known to produce less smoke than firewood. But the higher cost of kerosene makes this option unattractive for low income households, especially those with large families.

The local distribution and marketing of petroleum products is done by the government-owned Ghana Oil Company Limited (GOIL) and about five other private companies - Shell, Elf, Mobil, BP and Total. Nationally, the distribution of the retail outlets is highly skewed, with heavy concentration in the south, and in urban areas.

2.2.2 Electricity

Hydroelectric power is the main source of almost all of Ghana's electricity supply, both for domestic consumption and for export. Ghana exports power to neighboring countries including Burkina Faso and The Republic of Togo. It should be noted, however, that hydroelectricity constitutes a meager 7 per cent of the total national energy

consumption. Ghana relies on hydroelectricity from the Volta dam built across the Volta river at Akosombo in the 1960s and Kpong, with installed capacities of 912 and 160MW respectively (UNDP/World Bank, 1986). The production and management of these two plants are in the hands of State owned Volta River Authority (VRA). Thermal generation of electricity has also been undertaken by The Electricity Corporation of Ghana (ECG). More than 92 per cent of the electricity consumed in Ghana (about 5382 m.kwh) is produced at Akosombo (G.E.C, 1989).

Only about 15 per cent of the population of Ghana has access to electricity. Of these, three-quarters live in the five southern cities of Accra, Kumasi, Tema, Takoradi and Cape Coast (figure 2.1). There is virtually no rural community with access to electricity (Agbenohevi, 1989, Nkum and Woreko-Brobbey, 1989). This reinforces the notion of rural-urban dichotomies in development and living standards. Apart from the rural-urban dichotomy, there is also a north-south polarization in the level of development and hence the use of hydroelectricity, as is confirmed by the two regions chosen for this thesis. All the district capitals and all settlements in the Ashanti region with population of more than 5,000 enjoy electricity from the national grid. The same cannot be said of the Northern region. Here, only about half of the district capitals enjoy electricity from the national grid, and no settlement below the status of a district capital enjoys this facility.

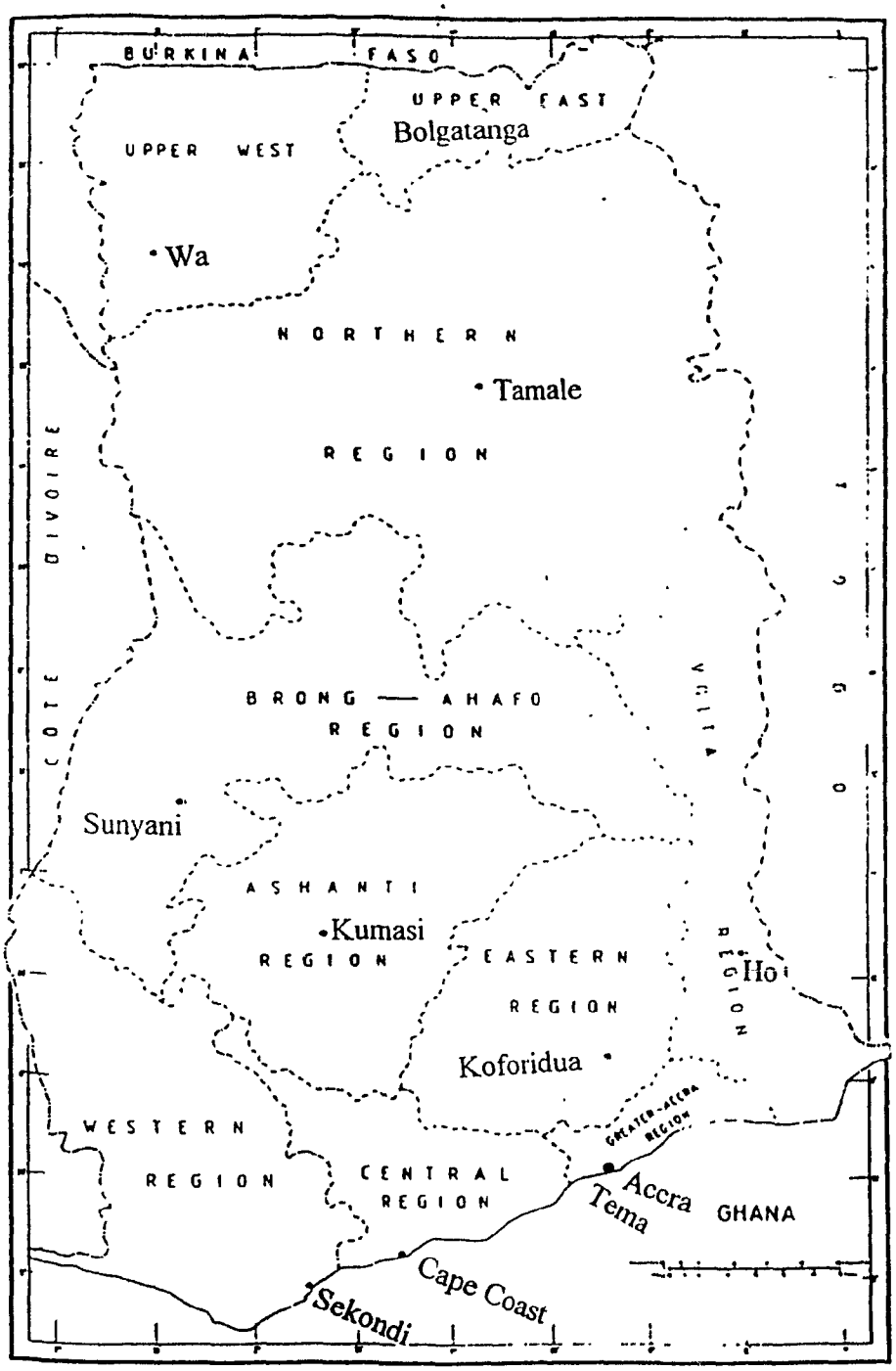
Besides Akosombo and Kpong dams, which have been harnessed, two more medium and 40 mini hydro sites have been identified. It is estimated that the untapped potential constitutes more than 50 per cent of the total national potential in hydro power (EPC, 1991). About a third of the total power generated in Ghana is consumed by the

Volta Aluminum Company, VALCO. Nationally, industry, construction and the service sector use more than 70 per cent of the total electricity produced in the country. Only 10 per cent of the electricity produced nationally is consumed domestically (G.E.C., 1989). It is also estimated that only 39 per cent of the people in urban centers use electricity. In urban centers like Accra, Kumasi, Sekondi-Takoradi and Tema, there are slum or squatter settlement areas which do not use electricity. The reasons are many.

Firstly, most of the houses in the slums are considered substandard and therefore do not qualify for power extensions. Secondly, people living in slum areas are poor and cannot afford initial costs involved in the extension of power to their homes. Even if they can make the initial investment, the accompanying power bills would be a drain on their incomes. Some of these slum dwellers have illegal connections of power to their homes. The main reason why these people do not use the available power for cooking is the high prices of cooking stoves and other electrical appliances.

Since 1966, various political parties and governments have used the extension of electricity to all parts of the country as a "political card," to win votes. It was not however, until the late 1980s that the government has made a real attempt to connect the north and rural South to the national grid. The Provisional National Defense Council (PNDC) began what it referred to as the Rural Electrification Scheme, with the aim of extending electricity to all parts of the country between 1990 and the year 2020. Under this scheme, most of the district capitals of the Brong Ahafo, Northern and the Upper Regions have already been connected. The current National Democratic Congress (NDC) government, an off-shoot of the Military (PNDC) regime is continuing that trend.

Figure 2.1 Administrative map of Ghana



3.2.3 Solar energy

Solar energy is used on a massive scale in all parts of Ghana for a variety of purposes, including drying laundry, agricultural products, and brick and tile. It would be extremely difficult, is not impossible, to measure the total amount of solar energy used since the vast majority of people use the energy directly from the sun, without any attempt to convert it technologically for efficiency and storage. With regard to technologically converted solar energy, "...more than 300 communication installations in the country are solar based. Studies to identify and standardize photovoltaic solar (PV) systems and models suitable for Ghana are almost completed" (EPC, 1991, p. 33). Pilot studies are also under way to find a suitable way to substitute solar energy for oil in large scale crop drying and storage.

It could be said that notwithstanding the above, Ghana has barely begun to seriously consider the energy potential of the sun. Ghana has the potential to exploit solar energy all year round. The conversion of the sun's rays with the aid of technology for efficiency and storage could not only prove to be the core energy resource for achieving improved living standards, but would also drastically decrease the current pressure that we put on the environment by way of harvesting wood resources for energy. It could also prove to be the vehicle for the improvement of lives in the vast areas if rural Ghana.

2.2.4 Woodfuels (Firewood and Charcoal)

The energy budget of most developing countries, including Ghana is heavily dependent on woodfuels. There is a problem of estimating what proportion of the energy

budget of Ghana is dependent on woodfuels. As observed by Baffuor (1985), a great deal of the consumption of these energy sources goes unrecorded. The most reliable estimates of the country's energy budget dependent on woodfuels range from 70 per cent (Baffuor, 1985) to 75 per cent, Nketia, et al (1988). According to Anderson (1988), the consumption of fuelwood in low income countries is typically about ten times the total consumption of commercial energy for all purposes, including transport and electricity generation.

The Ghana National Energy Board estimated that in 1990, fuelwood and charcoal use in the household was 6212 metric tonnes. This is expected to grow to 6522 by 1995 if action is not taken to guide the growth in consumption (Ashiboe-Mensah, 1989). The consumption of firewood is estimated at 0.93 cubic meters per person per year, with an above average consumption in the forest zone and below average consumption in the savanna zone. The consumption of charcoal is also estimated between 140 and 180 kilograms per capita per annum (Nketia, et al, 1988; UNDP/World Bank, 1986).

Generally, it has often been considered that woodfuels are the energy sources for rural Ghana, whereas other energy sources like electricity and petroleum products are the energy for the cities. Morgan et al (1981: 19) refer to rural energy, as those "forms of energy, all renewable, whose production is hardly ever measured and whose consumption is treated quite separately from other forms of energy. It includes wood, crop refuse, animal dung, the wastes from processing certain fruits and nuts, vegetable oils, plant materials deliberately cultivated for energy production, and the by-products of processing certain plant materials such as sugar cane, processed wood, more especially charcoal, and

wood wastes including off-cuts, saw dusts and bark." They also mention that "of these, overwhelmingly, the most important is wood, probably accounting for 83 per cent of noncommercial energy."

It is estimated that 82 percent of all wood cut in Ghana is used as firewood or charcoal. This, together with agricultural residues, makes up more than 72 per cent of the energy requirements of Ghana. For the remaining 28 per cent, the country relies on imported petroleum and hydroelectricity.

Wood is obtained for fuel by gathering dead wood and by cutting or burning the base of the tree. In rural areas, firewood is often got as part of the by-products of preparing land for farming, during the farming season. Other sources of fuelwood include sawmills, where cutoffs are sold to retailers. These, in turn, split them into smaller pieces for sale to customers. In the forest region, firewood producers, who mainly produce to satisfy the urban market, use chain saws to cut down trees. These are transported to urban areas, where they are sold mainly to the urban poor.

According to Nketia, et al (1988), charcoal "has been established as the predominant energy source in the urban areas of Ghana, providing a substantial proportion of the energy used for cooking and other domestic activities," with urban Ghana consuming about 476.8 thousand metric tonnes annually. They further state that 69 per cent of urban households of Ghana use charcoal as their predominant domestic fuel, with per capita consumption at 180.8 kgs per annum. The World Bank, however, estimates per capita charcoal consumption at 140 kgs per annum.

Charcoal is got by burning wood into carbonized wood. Production is mainly by the traditional earth-mound method, where fresh wood is packed in a shallow dug hole (traditional kilns). This is covered with earth and fire is set to the wood. The covered mound is left to burn for between a few days and a week, depending on the quantity of wood in the kiln, until cooling and carbonation is complete. The charcoal is bagged and transported to selling points.

2.3 Woodfuel Uses

The importance of firewood and charcoal as energy sources can be seen in the use to which they are put in the home. The various uses of firewood and charcoal in the home include food preparation and processing, lighting, heating, and small scale artisanal activities. Several factors determine the choice of firewood or charcoal as the primary energy source. These include the availability of any one type (this has to do with seasonality), price, burning quality and convenience. With regard to burning quality, issues considered are burning duration, heat generation, smoke content, storage qualities and the specific use for which the energy is to be used. For example, the local blacksmith and goldsmith would prefer charcoal to firewood because it is easier to handle, has less smoke and is compatible with the design of their equipment. Those who need large amounts of energy and for longer periods like oil extraction (both oil palm and shea butter), "pito" brewers (a local northern Ghanaian alcoholic beverage), and others like those who prepare meat and meat products at the slaughter houses would prefer firewood.

3.4 Summary

In his paper "What is so difficult about growing wood for energy in Ghana," Owusu (1989) raised some very pertinent questions that need answering if there is to be any successful solution to the woodfuel and deforestation problem. Among other things, he mentioned that there are four principal issues to consider in growing wood to meet the growing demand for wood for energy: the commitment to plant, raising the material to plant, planting or the initial establishment of the tree crop and finally maintenance, harvesting and regeneration.

If Ghana is to have a sustainable source of energy and if Ghana is to reduce the rate of deforestation, there is a need to harness alternative sources of energy. It is also necessary to examine the roles that solar energy, hydroelectricity, and petroleum can play. There is no doubt that solar energy has the potential for replacing woodfuel as the most affordable source of energy in Ghana. The problem with solar energy is the initial capital investment required to tap the energy for efficiency and storage. Taking the living standards of the people, especially in rural areas, into consideration, there is no doubt that any attempt to introduce the effective use of solar power would have to involve some assistance of some form from the government. It is only when the government is prepared to subsidize the cost of solar panel installations can there be any meaningful success. In the short term therefore, solar energy is not a viable option in replacing woodfuels as the principal household energy source.

Ghana can also take advantage of the vast hydroelectricity potential to reduce the pressure on forests in providing the required energy. As noted above, two medium and 40

mini hydro sites have been identified. There is the need to develop these to provide an alternative source of energy for the vast majority of rural areas. There is also the need to extend coverage of areas currently served by the national electricity grid. In this direction, it is significant to note that in recent years, with the government's rural electrification program, several medium size towns have been connected with the national grid.

It should be realized that making electricity available to the people does not necessarily mean that people would use it to satisfy their energy needs. The example of the urban poor demonstrates that even if electricity is made available, the average rural family would, at best, use the power for lighting the home and still use fuelwood for other more energy consuming activities like cooking. The main reasons why poor households would be inclined to continue to use woodfuel for cooking include the high cost of initial basic equipment and appliances like electricity-compatible stoves needed before a family can use electricity, and the cost of paying for electricity bills.

This chapter not only examined the types of energy used in Ghana, but also the pivotal role that woodfuels play in the overall energy budget of both rural and urban Ghana. It is apparent that not only is woodfuel the major source of energy for the vast majority of Ghanaians, especially in the rural areas, and to a lesser extent the urban areas, but that it would continue to be an important source of energy in the foreseeable future.

It has been observed that rural areas depend entirely on woodfuel as sources of energy for cooking and heating. For lighting the home, most rural households depend on kerosene. Urban areas on the other hand, rely on both woodfuels, and other sources of energy. For example, even large urban areas which are connected to the National

hydroelectricity grid, still have households using firewood and more especially charcoal for cooking, even though they may use electricity for lighting the home.

There is an urgent need to look at alternative ways of providing energy sources for Ghana. Ghana has great potential in areas of solar and hydro-power generation. There is a need for investment in developing the two medium size and 40 mini hydro sites to produce cheaper and more environmentally friendly energy. There is also a need to develop better and cheaper ways of tapping the vast solar energy potential. In doing this, attention should be directed at ways of making it affordable to the average rural household.

Until a viable alternative source of energy is found, however, Ghana, like all other countries in Sub-Saharan Africa, will continue to depend on woodfuel for energy. It is, therefore, important that even as research is being conducted into finding alternative energy sources, there should be continuing examination of sustainable ways to harvest woodfuel. The future of Ghanaian forests and wood resources is threatened by the increasing demand for woodfuel. There is the urgent need to develop strategies to safeguard the integrity of the forests and wood resources in Ghana.

The key to protecting Ghana's environment and also ensuring a continuous supply of woodfuels is to ensure that, at the very least, what is harvested equals or is less than what is planted. In achieve this, education on the importance of developing a tree planting culture. The next chapter will focus on deforestation in Ghana, emphasizing the causes and effects of deforestation and the pivotal role that wood fuel extraction plays in the deforestation process.

Chapter Three

Deforestation in Ghana - Causes and Extent

3.1. Introduction

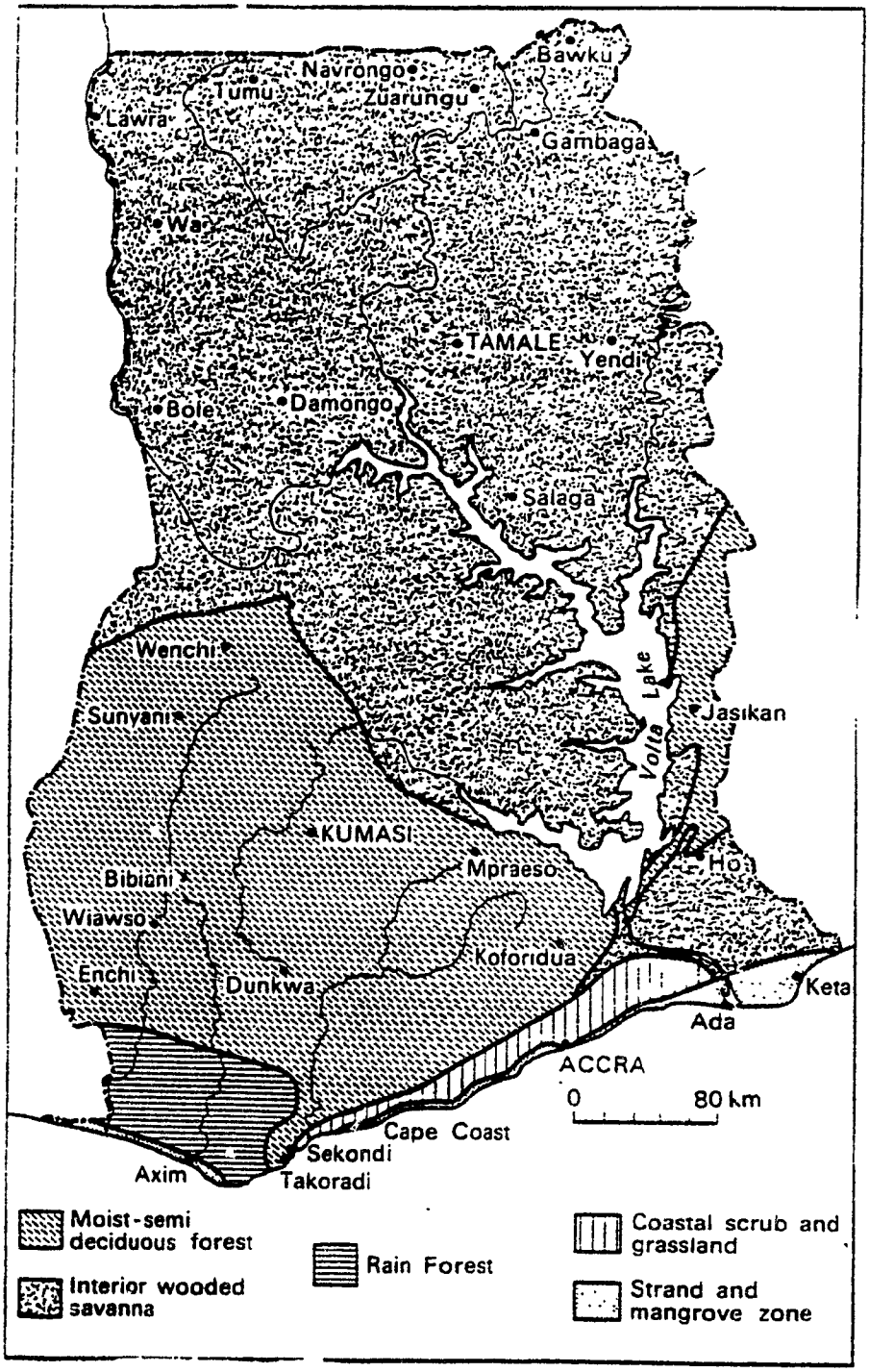
Ghana, like most developing countries, is mostly dependant on its environmental resources for socioeconomic development. In the case of Ghana, land and forest resources form a major part of the resource base that the country relies on for sustenance and development. Timber from the forests of Ghana have formed a very important source of foreign exchange for the country. Apart from that, the forests of Ghana play a tremendous ecological and environmental role in relative humidity, rainfall, air quality, water retention, soil erosion and fertility. Despite these important functions of forests, Ghanaian forests are fast disappearing, a matter of concern not only to researchers, but to successive governments in Ghana for some time now.

This chapter will examine issues related to deforestation in Ghana. A presentation of the extent of forest resources and the extent of deforestation in Ghana is followed by a historical account of the problem and some of the consequences of deforestation.

3.2 Ghana's Forest Resources

Using ecology as a basis for classification, Ghana can be divided into two zones - the closed forest zone and the savannah zone . The forest zone comprising the rain forest and the moist semi-deciduous forest. The Savanna zone, on the other hand, is made up of the coastal scrub and grassland, strand and mangrove vegetation on the coast and the interior wooded savanna(figure 3.1).

Figure 3.1 Vegetation Map of Ghana



The forest of the country, which is mainly in the south and west is made up of the moist semi-deciduous forest in the south of the country and the rainforest in the extreme southwest. This zone covers an area of about 8.22 million hectares, making up about 32 per cent of the total land area of Ghana (IIED, 1992). This zone has the largest tree stock, estimated at 180 million metric tonnes, and an annual incremental growth of about 2.5 metric tonnes per hectare. The annual rainfall of 1, 300 to 2, 200 mm. falls in two rainy seasons with an annual double maxima of rainfall.

The savanna zone on the other hand, can be subdivided into the interior savanna, which can be found in the north of the country and the coastal savanna, found along the coastal strip of the country. The interior savanna can further be subdivided into the open forested Guinea savanna that borders the semi-deciduous forest and the less productive Sudan savanna in the extreme northeastern corner of the country. This zone is estimated to cover about 13.6 million hectares, making up about 57 per cent of the total land area of the country. The zone has an annual rainfall of about 900 - 1, 300 mm. and contains about 120 million metric tonnes of growth stock, with an annual incremental growth of about one metric tonne per hectare (UNDP/World Bank, 1986). The coastal savanna covers nearly 5 per cent of the total land are and comprises 1.2 million hectares. With a low and unreliable rainfall regime, the area consists mainly of grassy plains and shrubs. In terms of the supply of timber and other forest resources, this zone is of little importance (IIED, 1992).

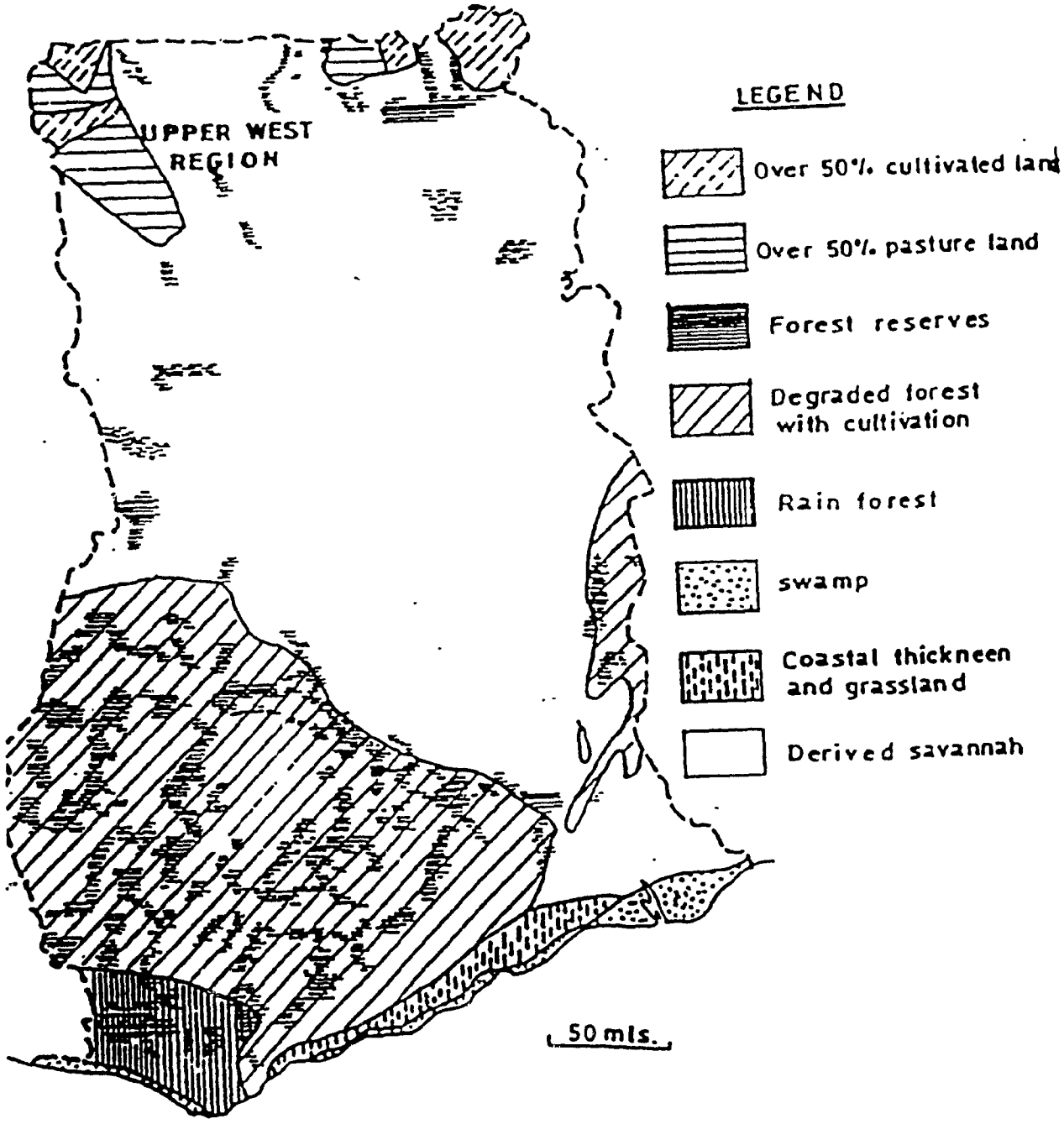
There is no doubt that Ghana's forests, like those of other tropical countries, are under intense pressure, especially in the last few decades. This pressure derives mainly from the myriad needs of humans. There is evidence to suggest that the entire area of Ghana was

once very well wooded (Obeng, 1990). Nsiah-Gyabaah, (1994) for example, showed that vast areas of the country have been turned into savanna by the work of humans. His map (figure 3.2), showed the areas of the country that have been converted into savanna. He refers to those areas as the derived savanna, signifying the "artificial" nature of the conversion. It is estimated that some two million hectares of the 8.22 million hectares of the closed forest remain today. Of the remaining forest, about 1.7 million hectares are forest reserves; the remaining 0.3 million are unreserved forests. It is significant to note also that the savanna areas of the country, even though less forested, are also under intense pressure and are equally in danger of destruction. Of the estimated 15.6 million hectares, 888, 600 hectares are reserved. Much of the rest, the unreserved areas, are fast becoming considerably impoverished as a result of farming and other human activities, such as bush fires and wood extraction (Tuffuoh, 1989).

3.3 The Rate and Extent of Deforestation in Ghana.

Most researchers and institutions agree that deforestation is one of the main problems facing the country today (Tuffuoh, 1989; EPC, 1991; Twum-Barima, 1981), but there is no reliable and adequate system of monitoring the exact rate of deforestation in the country. FAO/UNEP projected a deforestation rate of about 22, 000 hectares or 1.3 per cent per annum for the period 1981 to 1985. Since then, there has not been an update and this outdated figure is still the baseline for policy planning and projections in the country (EPC, 1991).

Figure 3.2 Map of Ghana depicting "Derived Savannah"



Source: Nsiah-Gyabaah (1994)

Significantly, since the FAO does not consider the extraction of wood, logging and forest degradation as "deforestation," the actual rate of deforestation may be considerably higher. Yeboah and Koranteng (1989) have suggested a deforestation rate of 2 per cent. Apart from the physical disappearance of trees, there is also the problem of the quality of the remnant forests, both outside and inside the reserves. The quality of these forests is being modified and it has been suggested that the most serious threat is faced in the forest and savanna ecosystems outside the reserves (EPC, 1991).

In the forest zone, deforestation is most serious around larger centers of population. Nationally, however, the Upper East region, which is in the Sudan savanna, faces the most serious threat. The region has very high cattle, sheep and goat densities and a human population of about 85 persons per sq. km, the highest in the country (Owusu, et al, 1989).

3.4 The History of Deforestation in Ghana

According to Smith (1975), humans have inhabited the country's forests for at least 5,000 years. It can therefore be assumed that for much of this period, the inhabitants of the forests have used patches of the forests for farming and other activities to satisfy their needs for sustenance. But it can also be assumed that due to the low total population for much of this period, not much harm was done to the forest ecosystem.

It has been suggested by Dickson (1971) that large-scale deforestation in Ghana actually began around the 1880s as a result of increased agriculture, gold mining, commercial logging and the development of infrastructures. During the period, the slave trade had been abolished, resulting in a drastic reduction in inter-state warfare. As a result of this, there was

an increase in population in the country. This, coupled with a boom in international trade in forest cash products like cocoa, coffee, cola and oil-palm resulted in an acceleration in the rate of population growth and deforestation in the country. This era, incidentally, also coincides with the British attempts to extend their control from the coast of the country into the interior to include the Ashanti empire and the Northern Territories, a move resisted by Ashanti, and which resulted in several bloody battles, leading to the final defeat of the Ashanti army in 1901.

The first cocoa farm in Ghana was established by Tetteh-Quashie in 1878, with cocoa beans he had brought from the island of Fernando Po. This was the beginning of the clearing of vast areas of prime forest for the cultivation of the cocoa bean, which was later to become the number one export commodity of Ghana. Mechanized gold mining in Ghana began in 1882 in Tarkwa. Since then, the rain forest and semi-deciduous forest areas of Ghana have lost vast areas to the mining industry (Hall and Swaine, 1976).

Timber exports from Ghana began in 1878, with the first shipment of mahogany. Techniques of timber extraction were not only laborious, but wasteful and destructive. The technique involved the dragging of felled trees out of the forest in the absence of roads and motor vehicles, unnecessarily destroying tracts of forests. To facilitate the easy transportation of timber and cocoa from the forest, and gold from the mines to the harbors for export, vast stretches of forest were cut down for the development of extensive networks of roads and the first rail lines. During this period, however, most forest clearing was done by small farmers. According to Gaisie and de Graft-Johnson (1976), the population of the forest zone increased from about 250,000 in 1850 to 750,000 in 1890.

Concern for deforestation in the country goes back to the beginning of this century, when the Conservator of forests was commissioned in 1907 to assess the country's forest estate and to prepare a report on the condition of the forests. The commission was also charged with the responsibility of drafting legislation for their administration (Kimble, 1963). The aftermath of this report was the creation of the Forestry Department in 1909 to manage and protect the forest estate. According to Unwin (1920), the first forestry policy empowering the Governor of the then Gold Coast (now Ghana) to establish forest reserves was drafted in 1911, with ". . . a view to conserve sufficient areas of forest to protect the ecosystem" (Bennuah, 1987). The selection, demarcation and constitution of these reserves in the closed forest zone began in 1919 (Asibey, 1970; 1978; Ghartey, 1990). It is reported that widespread opposition and resistance to the implementation of this plan prompted the Governor to pass the Forest Ordinance of 1927. Vigorous implementation began after the passing of this act and by 1939 about 1.6 million hectares of the closed forests had been set aside as reserves (Ghartey, 1990).

According to Twum-Barima (1981), at the beginning of this century, Ghana had a forest estate of some 88,000 sq. km. However toward the middle of the century, the forests were being depleted at an alarming rate. A forest Policy was enacted in 1948 to arrest the situation. This policy sought to encourage the creation of sufficient permanent forest resources by reservation of appropriate areas of forest or land for afforestation. This policy recognized the adverse effects of unregulated and unplanned mining of the forest resources on the ecology and the environment (Bennuah, 1987; World Bank, 1988). Despite the efforts of the government to safeguard the forest resources of the country, it has been estimated that

by 1950, only about half of the 1900 forest estate remained. Further estimates reveal that by 1980, only about 19,000 sq. km. of forests remained both in the forest and savanna zones (Frimpong-Mensah, 1989; Twum-Barima, 1981).

3.5 Deforestation in Ghana - Causes

As noted in the review of the literature, the causes of deforestation in the developing world are complex and interrelated. In the Ghanaian context, the most frequently cited causes for deforestation are agricultural expansion, bush fires, commercial logging, overgrazing and, last but not least, woodfuel extraction and production. It is important to note that these often cited causes are the visible manifestations of the underlying causes of population growth and poverty (Obeng, 1990).

Ghana's population is estimated to grow at the alarming annual rate of 3.2 per cent, one of the highest in the world. At the current rate, the country's 1984 population of about 12 million is expected to increase to about 29 million by the year 2010 (Tuffuoh, 1989). The fact that Ghana is a poor country with prevalent poverty is not one that most researchers would dispute. But as Köhlin (1993) mentioned, a combination of factors, such as population pressure, wrong economic policies, and political mismanagement has resulted in continuous and drastic reductions in the living standards of the people. It is important to note that population pressure and poverty, acting individually, or in unison, can trigger the following direct causal effects: agricultural expansion, logging, bush fires, overgrazing and woodfuel extraction. These are briefly discussed with reference to how they contributed, and are still contributing to the deforestation problem in Ghana.

3.5.1 Agricultural Expansion

Several experts have variously attributed the problem of deforestation in Ghana to farming activities. According to Benneh (1988), about 70 per cent of the deforestation in Ghana can be attributed to the adverse effects of farming activities, especially bush fallowing and cash crop production. In Ghana, small farmers have produced the bulk of the nation's food, using bush fallow agriculture. This farming practice has proven well adapted to the environment of most of tropical Africa. It has also been suggested that this practice is probably the best, environmentally, for the climate of tropical Africa, so long as populations were under control and adequate land was available was no problem.

Shortened fallow periods and declining agricultural yields have resulted in the conversion of about 72,000 hectares of forest land to farmland every year (Benneh, 1988). With population pressure, fallow periods have been significantly shortened and in some cases eliminated altogether, with a resultant reduction in crop yields, due to decreased soil fertility, declining and unreliable rainfall and a proliferation of weeds. Some farmers have sought to combat the problem of weeds with the application of herbicides. The use of chemical fertilizer has also been promoted by various governments. How many subistence farmers can afford the expensive imported chemical fertilizer is the question. One must not also lose sight of the environmental hazards associated with the use of chemical fertilizer (Adam, 1990).

Ghana has also over the years relied on the export of cash crops like cocoa, coffee and oil palm for much needed foreign exchange. The expansion of the cash crop farms has both direct and indirect negative effects on the forests. Between the mid-1950s and early 1960s, cocoa enjoyed very high prices both in the international market and at the local government

set prices. This prompted many farmers to migrate to the Brong Ahafo and Western Regions in search of land to establish cocoa farms and resulted in the clearing of vast tracts of forest land, both within and outside the established forest reserves (Tuffuoh, 1989). In addition to directly reducing the size of standing forest in the country, the increase in cocoa farms also reduced areas of agricultural land available for food crop cultivation.

Various governments' agricultural programs designed to boost food production in the country have also often resulted in the destruction of forest lands. For example, the Acheampong government's "Operation Feed Yourself" program in the early 1970s, geared toward curbing the importation of food by boosting local production, resulted in the systematic and indiscriminate destruction of large tracts of forest land for farming purposes. The cultivation of paddy rice, promoted under this program, reduced large tracts of forest lands to virtually treeless plains (Timberlake, 1988).

3.5.2 Logging

Over the decades, and especially since the 1960s, logging has been a very important foreign exchange earner for Ghana. Timber contributes about 6 per cent of the gross domestic product of the country and about 30 per cent of the country's export earnings (GTEDB, 1993). It is worth noting, however, that these significant contributions have been made at the expense of the environment and forest resources of the country. It has been estimated that for the years 1984, 1985 and 1988, a total of 2.7 million cubic meters of timber was produced. And by 1989, log production was about 1.3 million cubic meters per annum, of which about 40 per cent went into exports (Tuffuoh, 1989). With proper management, logging can be

sustainable, but in Ghana, it is often the case that the production of timber is ". . . guided more by market value than by management plan prescriptions" (Tuffuoh, 1989: 12).

The result is that logging is one of one of the principal causes of extensive forest damage in Ghana. As Tuffuoh (1989) has estimated, the timber resources in the unreserved forests are doomed to depletion by the year 2005, and the reserved forest would be the only source of timber in the country. It has also been shown by some that deforestation is taking place even in the reserved forests - from what is often referred to as selective logging. This results in the over-exploitation of the better known species (EPC, 1991). Another way logging contributes to deforestation is by opening the forests to farmers who would otherwise not be able to get access into the forests. By making roads to transport the felled trees, the timber industry leaves behind a legacy of trails and tracks which provides access into these forests for the farmers who are looking for new lands to cultivate.

3.5.3 Bush Fires

The ECA (1991) has estimated that about 40 per cent of West Africa vegetation is burnt annually. Burning forms an integral part of the farming culture of most Ghanaian farmers. It is a means of getting rid of huge mounds of unwanted twigs and cleared vegetation. But burning is also one of the major causes of deforestation in the country, and it occurs not only in the savanna zone, but in the forest zone as well.

Traditional farming systems entail the use of fire as a major clearing agent. Apart from burning down trees and other vegetation, fires also destroy organic content in the soil and consume tree seeds, thus hindering the regeneration of trees. Usually, farmers take the

necessary precaution to prevent the fire from spreading beyond the boundaries of the area intended for clearance. However, in many instances, these fires have gone out of control, spreading and destroying vast stretches of forest. Fires are also set for a variety of reasons, including hunting, pasture management and for social activities like festivals. Growing up in Bimbilla, the author remembers "bugum" or the fire festival. During this festival, torches of dry grasses were set ablaze and paraded in the principal streets to the outskirts of the town where they were cast into the bush. Many a bushfire was started this way.

Even though bush fires occur in the forest belt too, they are more extensive in the savanna zone. A particularly traumatizing period for Ghanaian forest and vegetation was the 1983/84 season when bush fires devastated most of the forests in the country. FAO conservative estimates suggest that more than 50 per cent of the country's vegetative cover was destroyed in 1983 alone (ECA, 1991). Ampadu-Adjei (1987) has intimated that between 1984 and 1985 alone, there were 1005 bush fires of which 307 destroyed large portions of the semi-deciduous forest. The aftermath of this experience was the enactment of the Bushfire Preventive Law in 1983 in order to prevent a recurrence of the problem. Apart from this, various volunteer squads were formed after the 1982/83 forest fires. These were basically local people coming together to prevent forest fires and to help put out any reported fires in the bush. Despite these preventive measures, bush fires continue to be one of the most important causes of deforestation in Ghana.

3.5.4 Overgrazing

In the northern part of the country, especially in the Upper East Region, unregulated livestock grazing is one of the principal causes of deforestation. As noted elsewhere, the Upper East Region is the most deforested area in the country, with the highest densities of livestock. The implications of growing livestock population in the face of no conscious management of available rangeland, is that growing pressure is exerted on vegetation through grazing (Nsiah-Gyabaah, 1994; Korem, 1985). Principal spots of overgrazing are localized areas around watering points and in areas where tenure conditions restrict herders from moving their animal stock over large areas relative to the size of the herd.

3.5.5 Woodfuel Extraction

A discussion of the deforestation problem in Ghana would be incomplete without a mention of the woodfuel factor. Concern over the use of wood as fuel emanates from the fact that the bulk of the wood is extracted almost exclusively from the natural forest, with very little coming from plantations or woodlots (EPC, 1991). Another trend is that because of the commercialization of the woodfuel trade, there is a gradual shift from the extraction of dead wood to that of fresh wood. This is basically because the regeneration of trees is not catching up with harvesting, thus necessitating the harvesting of fresh trees to supplement the dry wood extracted.

It has been estimated by the World Bank (1988) that total volume of wood used as fuel in 1988 was 13.9 million cubic meters. Of this amount, 6.5 million cubic meters was burned as charcoal. A better picture is painted when one considers that cutting for woodfuel

is ten times the annual log production of 1.3 million cubic meters (GTEDB, 1993). A growing concern among researchers is that large-scale production of charcoal takes place in the less forested savanna and the transition zone between the semi-deciduous forest and savanna zones. According to Nketia, et al (1988), 79 per cent of charcoal supplies come from the savanna woodland and the remainder comes from the forest zone. They also estimate that the size of forest destroyed in the charcoal industry annually is about 231, 454 hectares in the savanna zone and 42, 209 hectares in the forest zone.

What makes the problem a serious one is the fact that the demand and consumption shows no signs of decreasing, even in the face of dwindling stocks. Tuffuoh's (1989), estimate of the future of the woodfuel situation in Ghana provides a better picture of the predicament that faces Ghana if nothing is done to reduce woodfuel extraction from the current rates (figures 1.3 and 1.4).

3.6 Consequences of Deforestation in Ghana

The effects of deforestation are complex, interrelated and wide-ranging, affecting peoples far removed from the place the deforestation is taking place. As Park (1992) puts it, there is clearly a great deal more at risk from tropical deforestation than just trees. Just as the causes are complex, so are the consequences. These consequences range from environmental ones to socioeconomic ones. These two are briefly discussed below.

3.6.1 Environmental Consequences

Increased soil erosion, disturbance to water regimes, and in the extreme, desertification, are recognized as some of the consequences of deforestation. All these have negative effects not only on forest integrity, but also on agricultural productivity. It has been noted by various researchers that deforestation is exerting serious pressure on the soil resources in the country. Vegetal cover in extensive parts of the country has been removed, and when coupled with high and torrential rainfall results in a situation where the soils are easily eroded. As has been pointed out by Owusu et al (1989), large parts of northern Ghana have been subjected to moderate to serious sheet and gully erosion. This assertion is supported other researchers. For example, Asiamah (1986), estimated that 69,000 square kilometers have been subjected to moderate sheet erosion; 92,000 square kilometers to severe sheet and gully erosion and 54,000 square kilometers to very severe sheet and gully erosion. According to Asiamah, the most eroded part of the country is the northern region, where he estimated that 68,000 square kilometers have been subjected to erosion.

In this part of the country, soil erosion is seen as one of the most serious problems facing the people. It affects not only water retention, but also natural regeneration of vegetation and the productivity of agricultural and livestock systems. According to Adu (1972), there is so much erosion in the Upper East Region, that he estimates that as much as one meter of soil has been removed from moderately eroded soils and in seriously eroded areas, both the A and B soil horizons have been completely eroded, exposing the impervious substratum.

Another problem that is gaining increasing attention, especially in the northern part of the country, is desertification. In these parts, the development of desert-like conditions has been attributed to overgrazing of cattle, increasing demand for woodfuels and the pressure of declining arable lands as a consequence of shifting cultivation. As far back as the 1930s, Stebbing, (1935; 1938) suggested that the Sahara desert was expanding at the alarming rate of one kilometer per year. Since then, several other studies, have come to similar conclusions, except in the rate of change (UNCOD, 1977; Dregne, 1985). For example, Lamprey (1975) suggested that the Sahara was shifting southwards at the approximate rate of 5.5 kms per year. The UNSO (1985) estimates that the Upper East Region and the eastern parts of the Northern Region - an area of about 78, 700 kms or about 33 per cent of total land area of Ghana - face the most hazards. They also mention the Accra Plains as an area of risk. It is significant to note that a reduction in the quality and size of Ghanaian forests also affects the faunal diversity and numbers in these forests.

3.6.2 Socio-economic Consequences

Apart from the environmental consequences of deforestation in Ghana, there are other social and economic consequences as well. Firstly, environmental degradation, resulting in deforestation (or vise versa) has affected the lives of rural populations in the Northern and Upper Regions (Upper East and West Regions). A combination of soil erosion, ground water depletion and desertification has adversely affected the fertility of the soil in most of these areas. The result of this is a sharp decline in agricultural productivity, inducing a massive population movement southwards to the major cities in search of employment.

Deforestation often affects delicately maintained production and subsistence systems, with profound implications for employment, incomes and social relations, especially in rural areas in Ghana. As has been pointed out by Ossei-Wusu (1989), in the Eastern Region, where the cocoa industry was once a very important economic activity, the cocoa crop no longer thrives because of the depletion of trees. This is principally because cocoa does best under conditions of shade provided by much taller shade-providing trees strategically located throughout the farm. The loss of economic and financial resources through the loss of these cocoa plantations is very significant for the people of this area. In a similar vein, those who got employment as farm hands in this industry have been seriously affected. With a weak industrial base, unemployment is increasingly becoming a problem in these areas.

The forest of the country has provided employment for a considerable number of people, especially women, who have supplemented their meagre income by engaging in activities related to the gathering, processing and selling of forest products. For example, women in the northern part of the country, especially the Northern Region have relied on the collection of the shea nut, a wild fruit from the shea tree. This is processed into shea butter oil, and sold. The shea nut is also bought by government agents for export. A similar activity engaged in by women in the forest region is the gathering of kola nuts from the kola tree. These are dried and sold for income.

That deforestation has imposed considerable financial cost on the economy of the country is widely agreed. For example, Tutu and Convery (1990) estimated that in 1988, the total annual cost of environmental degradation in Ghana was US$ 128.3 million or 4 per cent of the GDP. It is estimated that of this amount, an estimated 33.4 per cent was accounted for

by the forestry sector by the depletion of forest resources through logging, fire, fuelwood collection, charcoal production and unsustainable agricultural practices.

3.7 Summary

Although there is some uncertainty and disagreement among the "experts" and researchers as to the rate of deforestation, the fact still remains that Ghana's forests are being depleted at an alarming rate and the country's forest resources are diminishing. It has been revealed that the country's forest estate of about 88, 000 square kilometers in the 1900s had been reduced by half by 1950 and is presently less than 18, 000 square kilometers.

The chapter has also shown that the causes of deforestation are complex and interrelated. Population growth and poverty have been identified as the principal underlying causes of deforestation in the country. There is some agreement in the literature to suggest that these two factors are the agents that set in motion the processes of agricultural expansion, forest fires, logging, overgrazing and woodfuel extraction. The relationship between population growth and poverty on the one hand and the environment on the other (as discussed in the literature review in chapter one) is very relevant in helping us understand the deforestation situation in Ghana. But these principal underlying forces only help to set in motion the set of factors that, acting alone, together, or in some combination, start the degradation processes and results in deforestation. It is therefore important not to view any of these factors in isolation, but in relation to the others.

Successive governments of the country must also bear their share of the blame for deforestation. Policies which emphasised the increase in food production at the expense of

the long-term environmental quality is blamed in part for the current state of the country's forest resources. Another of the immediate factors that has been identified as causing deforestation is logging. Although timber has been an important source of foreign exchange for Ghana, it has also taken its toll on the forests. It has been shown that logging can indeed be done on a sustainable basis using the right management practices. Unfortunately, evidence in Ghana suggests that financial, rather than environmental concerns, or a combination of the two (financial and environmental) is the principal deciding factor in the logging industry.

Bush fires, both natural and man-made, have also contributed significantly to the problem of deforestation in Ghana. The loss of vast tracts of forest in the 1983/84 farming season is an example of the problem that bush fires can create and how they do contribute to deforestation. Yet bushfires continue to be a major part of the farming culture of the small farmers, who form a majority of the farmers in the country.

A discussion of the causes of deforestation in Ghana, and for that matter any other country in Sub-Saharan Africa, cannot be complete without a mention of the dependence on woodfuels for fuel. A significant point to note is that the bulk of the woodfuel harvested is done not in woodlots or firewood plantations, but from the natural forests. The less forested savanna is also under intense pressure from charcoal producers The problem of overgrazing, especially in the Upper East Region, has also been identified as one of the principal causes of deforestation.

To sum up, deforestation has been shown to have very serious environmental and socio-economic consequences. Soil erosion has accelerated, in the absence of protective tree cover, with severe negative impacts on the food situation in the country. The degradation of

vegetation in the savanna and transitional zone has been blamed for the creation of desert-like conditions in certain parts of the country, especially in the Upper East and eastern parts of the Northern region. The loss of income and jobs as a result of deforestation has also been identified. A significant portion of the rural population, especially women who depended on the exploitation of forest resources for income have been most affected by deforestation.

Chapter Four

Research Methodology, Field Work and Study Area

4.1 Introduction

This chapter introduces the study areas as well as the methodological issues associated with this thesis. The introduction is followed a brief description of the study areas. This is followed a discussion of the primary and secondary data sources. Finally, the limitations and problems of the study are discussed.

The use of both statistical techniques and qualitative techniques was necessary because some of the questions this study raises lend themselves readily to quantitative analysis, whereas others simply do not. There was, therefore, the need to combine both techniques to be able to answer all the questions. Issues of environmental degradation do not exist in isolation and require consideration of demographic, socioeconomic and environmental factors affecting the quality of resources available to the people.

The author opted to use administrative districts instead of other delineation like tribal boundaries, watersheds or river basins because public, administrative and research records are already available on a Regional and District basis. It thus makes it easier to get access to compatible, previously researched material and other material like government records.

4.2 Study Areas

In choosing the study sites, several factors had to be taken into consideration. First, selecting the two villages to represent the two main vegetation zones in the country - forest and savanna in order to see the comparative differences and changes that have taken place

through time. Second, the ability of the author to speak all, or most of the languages in the selected villages and finally, selecting villages that were representative of the region. Chamba in the Nanumba District of the Northern Region (refer, figure 2.1) was the focus for the savannah belt. The site for the forest region was Nsuta in the Sekyere West District in the Ashanti Region.

4.2.1 Chamba - Savanna Belt

The Northern Region covers an area of 70,384 square kilometers and is about 30 percent of the total land area of Ghana (Nabila, 1992). The region has a little more than a million people and is one of the most deprived of the ten regions of Ghana with respect to almost all sectors of the economy including education, health and communication. According to the 1970 population census, more than 90 per cent of the population in the region lived in settlements of less than two thousand (2000) people. Even though this might have changed a little, it still gives an indication of how rural the region is in general.

The region has 13 administrative districts. Tamale, the administrative capital of the region, now ranks as the third largest city in the country. As far as infrastructure is concerned, the region is poorly serviced by roads. With the exception of a major trunk road which links the region to the south of the country and the two Upper Regions, all the roads in the region are dusty in the dry season and muddy in the wet season. Transportation is difficult all year round, and especially in the wet season.

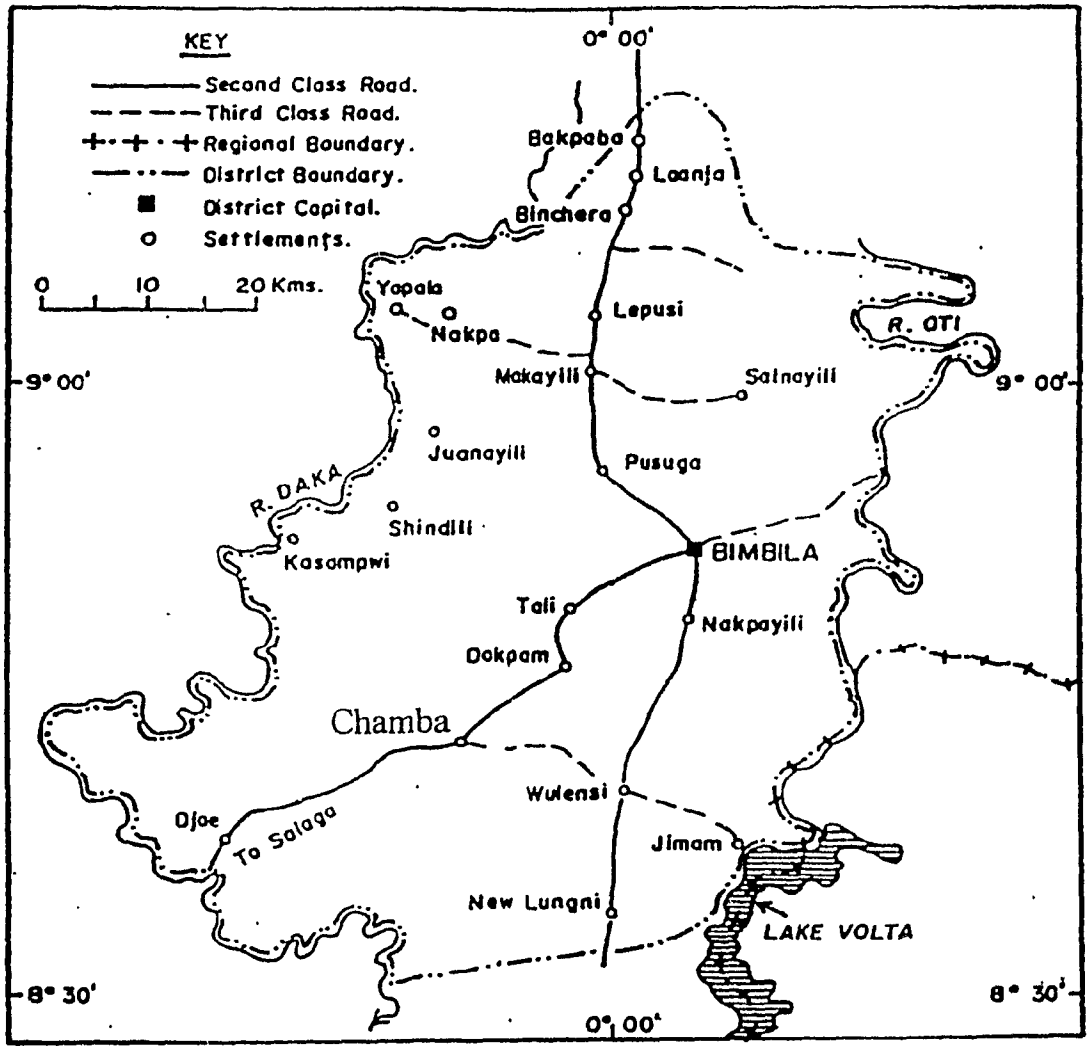
The Nanumba District (figure 4.1.) is one of the most rural and deprived of the districts, not only in the Northern Region, but in the whole of Ghana as far as health care,

education and communication are concerned. In addition, access to and within the district can be a problem, especially in the rainy season when almost all the roads become difficult for vehicular traffic.

Chamba is a village of about 1500 people situated on the road between Bimbilla and Salaga. The village was selected because of the diverse population representing a mixture of the several tribes found in the area. Even though the land belong to the Nanumba people, residents of Chamba are of diverse ethnic backgrounds. The main ethnic groups found in here were the Nanumba, the Konkomba, the Gonja and some Akans. With the exception of the Akans, who were mainly traders, the rest were mainly engaged in farming. One main attraction, apart from the remoteness of Chamba was the fact that the author could speak most of the languages found in the area.

The main disadvantage of this choice was accessibility. The village is serviced by only one road, linking it to Bimbilla, the District capital. To get to Chamba from Bimbilla, a distance of about 30 kilometers, one has to wait until a Friday, which is the market day. On this day, lorries and trucks convey traders from Bimbilla and other towns to Chamba in the morning and the return trip in the night. To make the work less difficult and also to save time, the author hired a cross-country vehicle for two 7- day periods. This vehicle conveyed the research team to and from Bimbilla during the administration of questionnaire and interviews.

Figure 4.1 Nanumba District



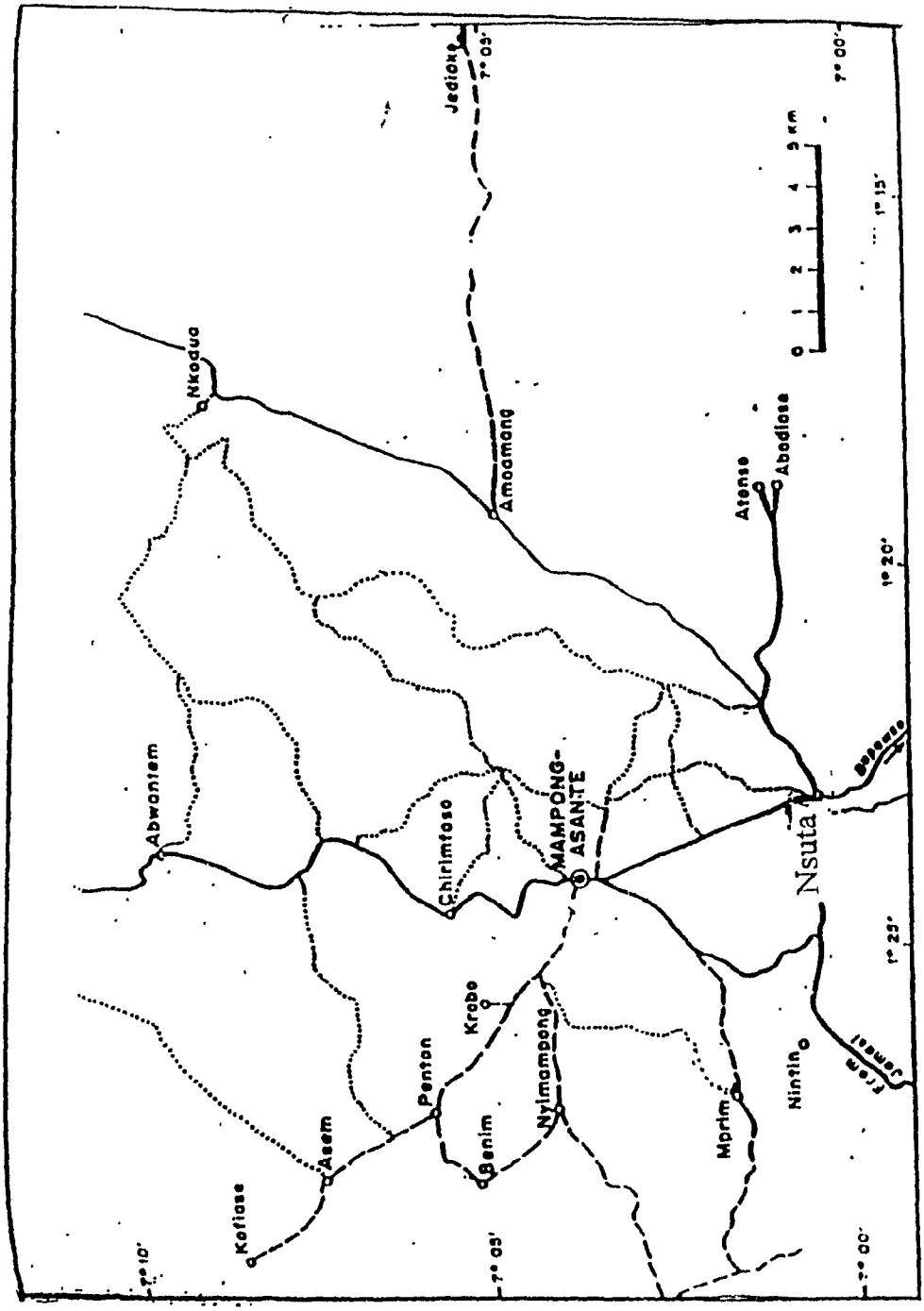
4.2.2 Nsuta - Forest Belt

The Ashanti region is in the semi-deciduous forest. The first reason for this choice is the fact that it lies in the forest region of the country. This allowed for comparison with the other district chosen from the Savannah belt. The other reason is that the author comes from this region and can speak the local language. This allowed for easy understanding of the different local terminology that was encountered without the need for translation.

Sekyere West District borders the Brong Ahafo Region to the north The northern part of the district lies in the transitional zone between the forest and the savanna areas. This afforded the research team the opportunity to see the gradual changes and problems associated with decrease in density of trees as one moved northwards.

Nsuta (figure 4.2) is a settlement of about 1700 people. The main language spoke here is Akan (Asante Twi). There are migrant farmers, mainly from the north and civil servants of diverse ethnic backgrounds. In choosing Nsuta, the author was guided by the need for a village that represented the region. Apart from the fading cocoa industry which is evident by the huge cocoa sheds and warehouses and almost abandoned cocoa farms - a recent feature of the Ashanti region, the village also had a thriving market place (every Thursday and Sunday), which drew the attention of the author. On the market day, people from surrounding villages came to Nsuta with their foodstuffs and other wares for sale. The author used these market days as occasions to meet and talk to different people from different parts of the district. Unlike Chamba, Nsuta has no problem of accessibility. The town is linked to Mampong, the district capital and Kumasi, the regional capital by very good roads.

Figure 4.2 Sekyere West



4.3 Sources of Data

According to Southgate et al (1991), there are two approaches to analyzing tropical deforestation - the case study approach and the statistical approach. The statistical approach is used in studies that involve the collection and analysis of data in large geographical areas. To use this approach, one must be certain that reliable and comprehensive quantitative data are available. Principally for this reason, the case study approach has constituted the main approach to analyzing the causes of deforestation in the tropics, in the absence of very reliable and detailed quantitative data on several relevant factors or variables in most developing countries. These two approaches are, however, not mutually exclusive. This thesis adopts the case study approach for obvious reasons, which include the absence of reliable and detailed quantitative data. This does not, however, preclude the use of quantitative techniques in analyzing some specific data.

The data and information for this thesis are derived from the research conducted by the author and his team of research assistants in Ghana during the summer of 1995. The working experience of the author in the District Planning Office of Amansie-East District Administration in 1990/1991 provided valuable information on the dynamics of woodfuel gathering processes and the probable links to environmental degradation and deforestation.

4.3.1 Primary Data Sources

For this thesis, several primary data sources were used. These ranged from the administration of pre-coded questionnaires, both formal and informal interviews with key

informants in selected villages and conversations with opinion leaders in the communities. The fieldwork for this thesis was undertaken between May and September 1995. May and the early part of June were spent on a pilot survey which also acted as a reconnaissance survey of the areas tentatively selected as study villages (Nsuta in Ashanti and Chamba in Northern). During this period, the draft questionnaire was tested to see how practical it was. This provided the basis for modification based on the realistic situation on the ground. The pilot survey of the 5 households in Nsuta and Chamba revealed that questions regarding personal income and other sensitive personal data had to be modified. Respondents were very reluctant to provide information regarding their income and other personal information. It also revealed that the head of the household could not answer all the questions, especially about firewood collection and time spent. As a result, the final questionnaire asked for those directly involved in the collection to answer those sections. The actual field work was conducted between mid-June and the end of August. For the informal interviews, respondents were from the two villages and other villages in the district. For Sekyere West district, other villages where informal interviews were conducted were Anansu, Beposu and Asuafu. In Nanumba district, the other villages where informal interviews were conducted were Taali, Sabonjida, Wulehi and Makayili. In all, 15 respondents were involved in each of the district in the informal interviews. Some of these informal interviews were conducted before the administration of the questionnaire and the rest done after the questionnaire administration.

Since this study involves an analysis of fuelwood sources and factors that affect their production, consumption, or sale, a systematic collection of primary data was of paramount

importance. The study used the household as a statistical unit for analysis Instead of aggregate regional or national data, this study concentrated on the household level to study the woodfuel problem in Ghana. Information was collected through questionnaires (appendix 1) administered to randomly sampled households in two villages of the Northern and Ashanti regions (figure 2.1). Thirty five respondents in Nsuta and Chamba were involved in the pre-coded questionnaire administration. In choosing which households to include in the sampling, the author encountered some problems. Nsuta is a very well-laid village with streets and alleys. This allowed for the village to be divided into quadrants in which the households could easily be selected. The same cannot be said of Chamba, where there was no planning in the development of residential housing. This made sampling in Chamba very difficult. Sometimes, the author had to cross farms and plantations to get to some houses.

Respondents were individuals who were asked to provide both household data and personal information. Some sections of the questionnaire were answered by the head of the household and others by members of the household. There was also the need to conduct formal interviews with official people (Ministry of Agriculture's extension personnel, health institutions) as well as a few in-depth interviews and discussions with selected families to understand some of the adjustments that the families have had to make and coping strategies which have evolved to help them survive with the changing times. Two families were selected in Nsuta and Chamba for the in-depth interviews. Finally, some traditional chiefs and elders in the two selected districts were interviewed to examine their role in conserving wood stocks and how these have changed over the years.

4.3.2 Secondary Data Sources

To augment the primary data collected, data was also collected from secondary sources. Information was sought from previous studies in the area to facilitate comparative and trend analysis. *Ghana Population census reports* from 1948 to 1984 were also consulted. Additional information was obtained from the records of some of the agriculture and health institutions in the two selected districts, from the district administration offices and from the Ministries of Agriculture and Health. Existing maps, diagrams and tables relating to the land and health of the people in general and more particularly changes that have taken place in particular were sought. The libraries of Wilfrid Laurier University and the University of Waterloo, the universities in Ghana, the Ghana Statistical Service and the Ministry of Health in Ghana were of importance. The regional libraries of the United Nations Development Program, the World Health Organization, the African Development Bank and other research institutional libraries in Ghana were also of immense benefit.

Like most developing countries, there is not enough documented data to work with. The problem is more serious in relation to information whose collection depends on the use of modern and expensive technology. A case in point is the non-availability of aerial photographs over several parts of the country, including the study villages. Air photographs are very important in the study of environmental issues such as deforestation, since they give a very accurate picture of the changes in vegetation cover. A lot of details which would have been very valuable in this study has therefore been lost as a result of the lack of air photographs.

The author spent September 1995 gathering secondary information in Accra, the national capital and Kumasi and Tamale, regional capitals of Nsuta and Chamba respectively.

4.4 Problems and Limitations of the Study

Village people are generally suspicious of outsiders who come into the village asking all sorts of questions. They tend to view researchers as government agents who are there to assess them to know how much taxes they should pay, or representing other forms of bureaucratic threat. In the two villages the author visited, the research team initially encountered some suspicion on the part of the villagers. Despite the great lengths the author went to assure them that this was a purely academic exercise, some of the respondents were still reluctant to answer questions which they felt were sensitive, especially when it concerned their incomes or the law.

One other practical problem that the research team had to sort out in the field was that of language. The research team tried to minimize this by carefully selecting areas that posed the least problems when it comes to language, but occasionally it was encountered. Ghana being a multilingual state with more than 50 different languages and a very high migration rate, there is no wonder that sometimes the author ran into respondents who spoke neither English nor any of the native languages of the study area, which the author had prepared for. There was therefore the need to hire additional research assistants who spoke those languages.

Another major problem encountered was the settlement patterns of the two selected villages. Nsuta in the Ashanti region is a fairly organized settlement. The settlement pattern here is nucleated with some amount of street and back alleys which could be used as coordinates in trying to divide the village into quadrants for sampling. The same cannot be said of Chamba, where the settlement is dispersed with no official map of the location of houses. Sometimes the team had to go through farms, thick bushes in order to reach some homes. This therefore made the work of sampling very difficult.

Transportation, especially in the north, was another problem that the research team faced. As mentioned elsewhere, the northern region of Ghana is noted for some of the worst roads in the country. Traveling between two settlements was a nightmare, to put it mildly. In order to reach our chosen village, the team had to hire a cross country vehicle from the regional capital in Tamale. Without this vehicle, it would have been possible to get access to the village only on Friday, which was the market day, and when large cargo trucks convey traders from Bimbilla and other surrounding villages to the village.

One final limitation of this study is in the scope of the study. Though the study objective is to study woodfuel production/consumption in rural Ghana, this thesis only sampled two villages, out of thousands of woodfuel producing and consuming villages in Ghana. The findings of this study, however, is likely to be representative of a majority Ghanaian villages. The general observations made involving the characteristic features of woodfuel production and consumption are likely to apply to most rural Ghanaian contexts.

While the above enumerated problems are considerable and worth noting, they do not however detract from the value of this thesis in highlighting important, but neglected issues involved in the woodfuel and deforestation debate not only in Ghana, but in all Sub-Saharan Africa.

Chapter Five

Fuelwood Access Patterns in Study Sites (Sekyere West and Nanumba Districts)

5.1 Introduction

Having given a broad overview of the types and uses of energy in Ghana, this issue will now be examined in the study areas in more detail. As mentioned in the objectives (1.10), part of the objectives of this thesis is to investigate the factors that influence the demand for, and use of woodfuels in rural Ghana. In connection with this, this chapter deals with options of energy sources available to rural people, the role of women and children in the collection of firewood, the role of traditional authorities and changes that are taking place.

Specifically, the author intends to examine the types of access to energy sources and their related constraints in the two chosen districts. First, the author examines those who collect firewood for use and the constraints or costs that are associated with it. This is followed by examination of those who purchase firewood in the study areas. Here, the author examines the reasons why people shift from collection to purchase and the constraints that go with them. Instead of dealing with the two study areas in separate parts of the chapter, an integrative approach is adopted to allow for easy comparison and analysis of the two areas.

5.2 Geographical Survey of the Study Sites

As mentioned earlier, Nsuta and Chamba, in Sekyere West and Nanumba Districts respectively, have been chosen as the study sites (figures 4.1 and 4.2). This

section is devoted to describing the physical and socio-economic characteristics of the two districts as a background to the chapter. Sekyere West is located within the semi-deciduous forest, with its northern part bordering the ecotone (the transitional zone between the semi-deciduous forest and the woody and grassy savanna). The district covers an area of about 610 km^2 and has a population of about 128,450 (Ghana Population Census, 1984). Nanumba District on the other hand is located in the heart of the savanna belt, covering an area of about 500 km^2 and with a population of about 90,000.

5.2.1 Physiography, Temperature and Precipitation

Physiographically, the Sekyere West District lies within the voltaian basin, the southern part of which is marked by the voltaian plateau (Mampong scarp). Land is generally undulating between 300 and 700 metres above sea level, with scarp peaks reaching 750 metres at Ofin headwaters, near Mprim. The district has a mean annual temperature of 25.3^{0}C and a mean annual rainfall of 143 cms. Diurnal temperature ranges can be as high as 11^{0}C (Dickson and Benneh, 1988). The main types of rock found in the district are paleozoic voltaian formations of shale, sandstones, mudstones, and conglomerates. Soils here are mostly forest ochrosols, very rich in organic matter (mostly from falling leaves) that support staple and tree cash crops. This soil however has a very thin layer of rich soils and is dependent on continuous vegetation to provide nutrients. The soil is therefore very vulnerable to soil erosion when exposed to the frequent torrential rains at the start of the rainy season. This is why it is necessary to rest the soils for regeneration under the bush fallow system of agriculture. The district lies within the area

that experiences double maxima rainfall annually. The first, from May to August, the long maximum, and the short maximum in September and October (Dickson and Benneh, 1988).

The Nanumba District on the other hand, lies in the southeastern corner of the Northern region. Physiographically, the district lies in the northern dissected plateau and is bounded in the north by East Dagomba District, in the west by East Gonja district and in the south by the Volta region. Unlike the Sekyere West District which experiences double maxima rainfall, the Nanumba District lies in the savanna zone and has a single maximum of rainfall annually. The rainy season is from May to October, with a protracted dry season from November to April. Mean annual temperature is about 27.7^0C, with mean annual rainfall at about 120 cms.

The area has tropical ferruginous soils. These are zonal soils developed under 500 to 1200 mm annual rainfall sharply marked by dry and wet seasons. They are highly weathered and markedly laterised by the loss of silica. One common feature of the soil is leaching. Another is the separation of free iron oxides which are deposited in the profile in the form of mottles, concretions, or a ferruginous hardpan. They have very shallow profiles and most of them are less than 150 cms in depth. The water holding capacity of this soil is moderately good, but depends primarily on its structural conditions. There is a tendency for the soils to form surface crusts and they are highly erodible. The agricultural value of this soil is usually rated as poor to average at best.

5.2.2 Agriculture

As mentioned earlier, the bush fallow system is the dominant system of agriculture in Ghana, but large scale mechanised holdings in rice, cotton, and maize fields exist in, and around Chamba. Around Nsuta, one can see cocoa and oil palm plantation, that reminds one of gone by years, when the cocoa industry was flourishing in this area Today, however, most cocoa farmers have migrated to remote parts of Western and Brong Ahafo regions in search of rich virgin forests. The main crops grown in Chamba are yams, maize, guinea corn, millet, peanuts and cow peas. For Nsuta, the main crops grown are cassava, maize, cocoyam, plantain and banana.

Most farmers in Ghana practice intercropping/mixed cropping, using simple implements like the hoe and cutlass. Farmers in the two areas are very adept at crop rotation, knowing which crops to plant on which particular plot, in which season and in what succession.

5.3 The Role of Traditional Authorities with Regard to Land as a Resource

One very important distinction that must be made between the two study sites is the role that traditional chiefs have played, and continues to play, in the management of forest resources. Based on the author's observations and conversations with opinion leaders in the two areas, it was deduced that lands referred to as "common property" was more a phenomenon in the northern site than the south. This was because around Nsuta, most lands belong to one family or another. Very little land was referred to as "stool

lands". This means that traditional authorities have little or no jurisdiction when it comes to what is done to the land.

In the case of Chamba, land was regarded as belonging to a family only when it was under current cultivation or was recently cultivated by a family. Even in that case, it was not permanent holding, but temporary, as long as the family intended to cultivate that piece of land again. An example of how land can be claimed for cultivation is provided by Afa Issah of Chamba:

> When I want to farm a piece of land next year, I go and mark the area in question, by tying some piece of grass around the boundaries by the road side. This is left for as long as possible. If no one also ties any grass by the side of the one I tied, then I can assume that no other family intends to cultivate the land and then the land is mine. But if some other family wants to lay claim on that piece of land, then they also tie some piece of grass next to mine. We identify each other, sit down and resolve the problem by seeing which family farmed on that piece of land in the very near past. If we are unable to resolve it (which is very rare), we go the sub-chief for arbitration (Personal interview, September, 1995)

This system is very suitable for the area due to the sparse populations. Even migrants do not have to pay anything to farm in this area. In this system, some traditional chiefs played very important roles as custodians of certain valuable trees and areas, so that before one cut down those trees, one had to go to the chief to ask for permission. They also served as mediators in case of disagreement on which family should lay claim to which piece of land.

It must be noted, however, that with modernization and the shift of power from local authorities to the central government, the power base of these chiefs is gradually being eroded. Now, when residents have disagreement on land rights and other similar problems, instead of petitioning the chief or the sub-chief, they seek redress by litigation in the law courts.

5.4 Household Characteristics

Since this study uses the household as the basis for analysis, a profile of the households interviewed is provided. This is important because, among other things, the characteristics of the household generally influence the consumption of energy in the household. For example, the size of the household determines whether the household uses large or small quantities of firewood or charcoal. Another important characteristic is the income of the household. The income of the household has the important effect of influencing the types and quantities of fuel used. As income increases, it is reasonable to assume that energy consumption also increases. Income increases may also result in households cutting back or eliminating the use of traditional fuels in favour of modern ones. In other words, higher incomes may increase the ability of the household to substitute less efficient fuels with efficient, modern commercial fuels (Openshaw, 1978).

Table 5.1 the household sizes for Nsuta and Chamba. Household sizes in Nsuta ranged from 6 to 20. For example, 7 households had 6 - 9 members, 17 households had 10 - 14 and the remaining 11 households had 15 - 20 members. In Chamba, 11 households

had 6 - 9 members, 16 had 10 - 14, a further 6 had 15 - 20 and finally 1 household each had 21 - 25 and 26 - 29 respectively.

Table 5.1 Household size

Household Size	Nsuta	Chamba
6 - 9	7	11
10 - 14	17	16
15 - 20	11	6
21 - 25	-	1
26 - 29	-	1
Total households	**35**	**35**

Source: Fieldwork, 1995

Table 5.2 below represents the educational profile of the respondents in the two villages. It can be seen from the table that most of the respondents were illiterate. The literacy level is, however, higher in Nsuta than in Chamba. Comparing the two villages, the percentage of respondents who were illiterate in Nsuta was 40 as against 71 in Chamba. In the same vein, for those with some secondary education, they made up 26 per cent of the respondents in Nsuta and only 6 per cent in Chamba. Finally, with respect to tertiary education, they made up 14 per cent of the respondents in Nsuta as against 3 per cent in Chamba. This reflects the general trend in the country, where illiteracy is higher in the north than in the south.

Table 5.2 Educational profile of the respondents in Nsuta and Chamba

Educational Background	Nsuta		Chamba	
None (illiterate)	14	(40%)	25	(71%)
Primary education	9	(26%)	7	(20%)
Secondary education	7	(20%)	2	(6%)
Tertiary education	5	(14%)	1	(3%)
Total	35	(100%)	35	(100%)

Source (Fieldwork, 1995)

As mentioned in chapter four, 35 questionnaires each were administered to households in Nsuta and Chamba. Of these households, 9 of them in Nsuta (26 per cent) and 5 in Chamba (14 per cent) had female household heads. Most of the respondents in Nsuta were between the ages of 40 and 49 as compared to Chamba where most of the respondents were between the ages of 30 and 39 (table 5.3).

Table 5.3 Age of Respondents

Village	**Nsuta**		**Chamba**	
Age of Respondents	**Male**	**Female**	**Male**	**Female**
20 - 29 years	-	-	3	1
30 -39 years	3	2	12	3
40 -49 years	15	4	7	-
50 -59 years	3	2	4	-
60 -69 years	3	-	4	-
70+ years	2	-	-	1

Source: Fieldwork, 1995

Martin (1956) observed that rural dwellers are generally extremely reluctant to reveal details of their economic life. One way to have some indication of income levels is to ask of occupation. Respondents in the field were asked to indicate the occupation of the head of the household. Although this does not give the actual income of the household, it at least gives an indication of the income level or the economic status of the household. Since most of the respondents were farmers, not much information could be discerned from this, except for those in government employment.

Table 5.4 Principal and secondary occupations of the household heads

Village	Nsuta		Chamba	
Type of Occupation	Primary Occupation	Secondary Occupation	Primary Occupation	Secondary Occupation
None	-	31.4	-	34.3
Farmer	85.7	2.9	88.6	2.9
Government employee	14.3	-	8.6	-
Fuelwood seller	-	17.1	2.9	34.3
Prepared food seller	-	8.6	-	11.4
Trader	-	28.6	-	11.4
Other	-	11.4	-	5.7
Total	**100**	**100**	**100**	**100**

Source: Fieldwork, 1995 N=35 (100 per cent responses)

As can be seen from table 5.4, the main occupation of the people of the two study villages was farming, with some people - 14 per cent in Nsuta 9 per cent in Chamba - employed by the government. Most respondents in the two villages also had some form

of secondary occupation to supplement income from the first occupation. An important observation made here was that in Nsuta, all those with tertiary education were government employees, the rest had farming as their primary education. In Chamba, all those with secondary and tertiary education were government employees and the rest were farmers.

5.5 Household Fuelwood Sources

From the surveys, it was overwhelmingly apparent that the majority of rural people relied on firewood as their major source of energy. Table 5.5 shows the types of access to firewood in the two study areas.

Table 5.5 Type of access to firewood in Nsuta and Chamba

Village	Collection (Exclusive)	Purchase (Exclusive)	Both	Don't use
Nsuta	57.1	11.4	20	11.4
Chamba	82.9	-	14.3	2.9
Total	**70**	**5.7**	**17.1**	**7.1**

Source: Fieldwork, 1995.

As can be seen from table 5.5, in Nsuta, about 57 per cent of the interviewed households collected their firewood needs. This is a much lower figure compared to Chamba where more than 82 per cent of respondent households reported collecting their firewood needs. One reason that could account for this is the fact that Nsuta is much more integrated in the national monetary economy than Chamba, simply by virtue of the fact

that Nsuta is situated in the south where there is a higher level of development as compared to the north.

As a result of the general higher level of deforestation in the north, it was assumed that firewood would be scarcer in Chamba compared to Nsuta, therefore creating a demand which will be satisfied by purchase, even in the rural areas. Contrary to that, we discover that the generally lower level of development in Chamba coupled with the still flourishing non-monetary economy offset the impact of scarcity. Whereas about 11 per cent of the respondent households in Nsuta reported exclusive purchase of firewood, none of the respondent households in Chamba reported this. This means that even though it was generally more difficult to get firewood in Chamba compared to Nsuta, none of the respondent households were totally reliant on the exclusive purchase of firewood (refer 5.6.1)

Another thing pointed out in the table is the percentage of respondent households who did not use firewood at all. About 7.1 per cent of rural households do not use firewood at all. Breaking this down, 11 percent of respondents in Nsuta reported that they did not use firewood at all. This contrasts with 2.9 per cent in Chamba. The reasons for this may be related to level of formal education and the use of charcoal which would be discussed under the use of charcoal.

5.6 Those Who Collect Their Firewood

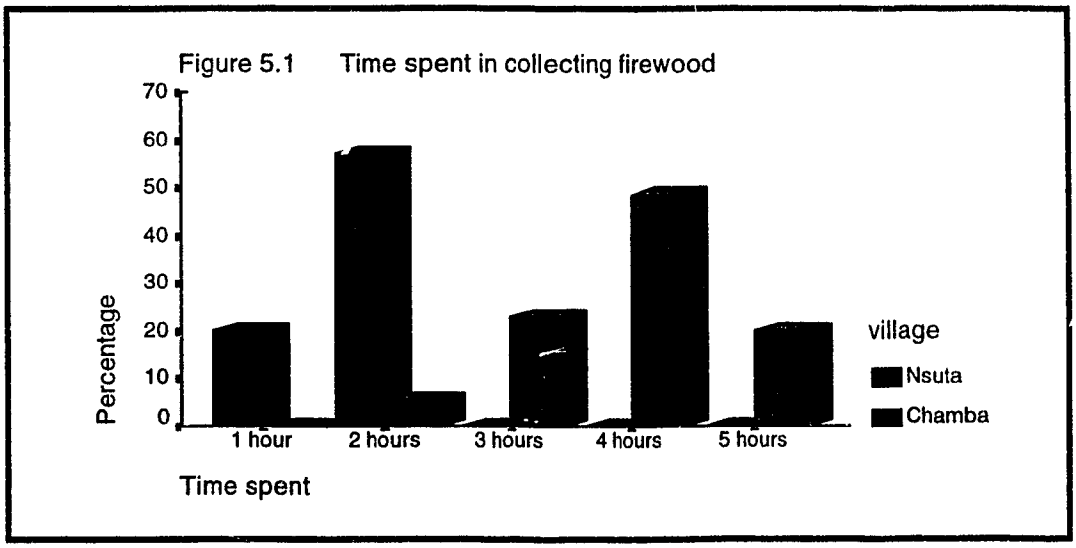
As mentioned earlier in the introduction to this chapter (section 5.1), each type of access to firewood chosen by any household has attendant constraints in labour, time or

money. In this section, the author examines the constraints or costs associated with those who collect their firewood.

5.6.1 Time Constraints

There is a marked difference in the time spent in the collection of firewood in the two areas. (Figure 5.1).

Figure 5.1 Time spent in collecting firewood

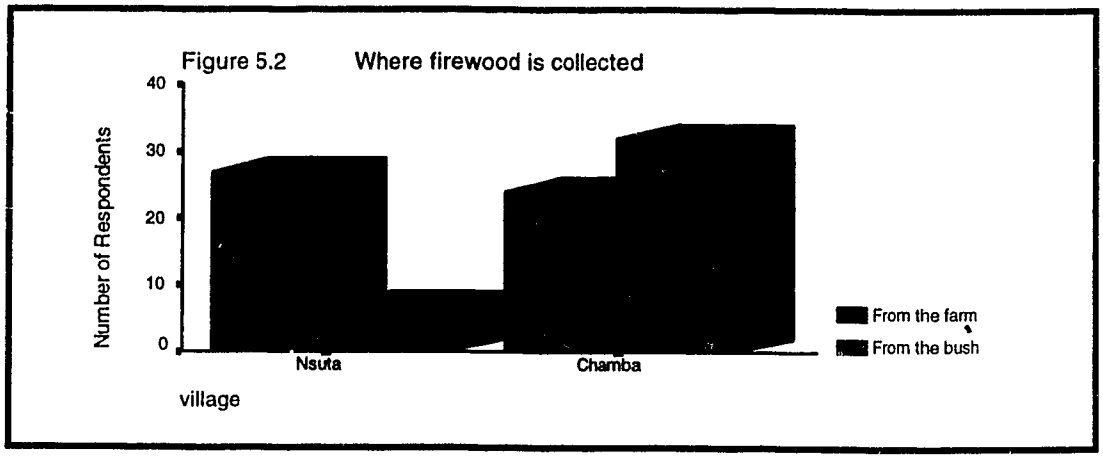


Source: Fieldwork, 1995

Respondents in Chamba spend more time collecting firewood than in Nsuta. Whereas respondents in Nsuta spent between one (20 per cent) and two (57 per cent) hours in the collection of a head load of firewood, the story in Chamba is much different. Here, the least time spent is two hours (6 per cent). About 23 per cent of respondents spend three hours, 49 per cent spend four hours and 20 per cent spend five hours.

In order to save time, some households collected firewood as part of other activities. In Nsuta, 51 per cent of the respondent households said they looked for

firewood when they were doing other things. The figure for Chamba is 54 per cent. About 43 per cent of the respondent households in Chamba reported that they made special trips to look for firewood. This is a much higher figure than in Nsuta, where only 26 per cent of the respondents reported any special trips for firewood. One of the reasons for a higher percentage in Chamba undertaking special trips for firewood may be because as high as 91 per cent of them reported that areas they looked for firewood included the bush. Only 20 per cent of the respondents in Nsuta reported this. On the whole, respondents collected firewood from two main sources. This is from their farms and the bush. The bush here includes fallow lands and all other uncultivated lands. The responses are illustrated in figure 5.2.



Source: Fieldwork, 1995

One other issue investigated was how often firewood was collected. Interestingly, even though Chamba reported a longer distance covered in the collection of firewood, they went for the collection of firewood more often than those in Nsuta. For example,

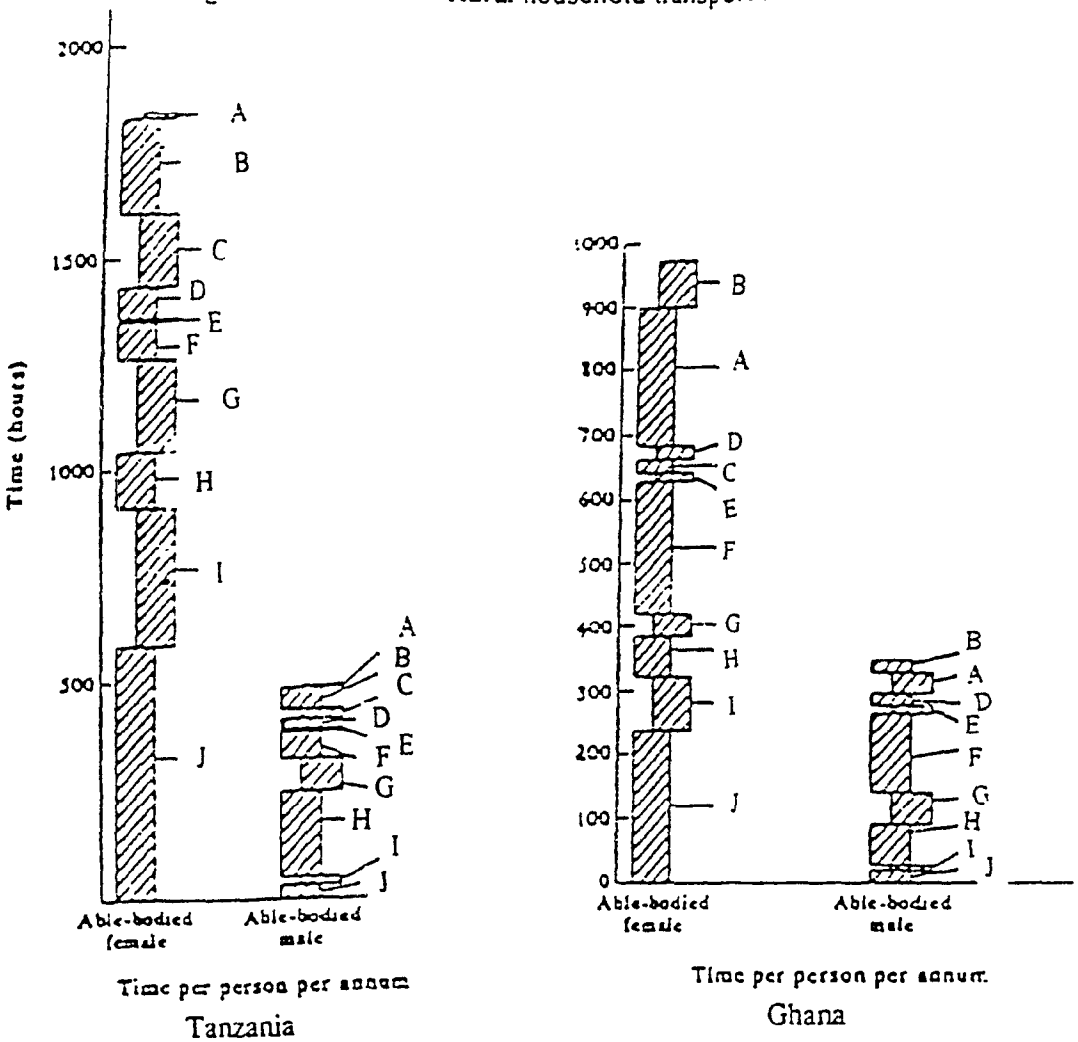
about 69 per cent of the respondents reported that they went for firewood daily. The rest reported every other day (26 per cent) and weekly (2.5 per cent). In Nsuta, only 2.5 per cent of the respondents reported going for firewood on a daily basis. About half of the respondents reported weekly collection of firewood and 26 per cent reported every other day.

5.6.2 Responsibility for Collection

In line with the second objective of examining the relative impact of wood scarcity in the study areas (1.10). the issue of who collects firewood in the household was examined. The work done by Barwell et al (1987) and cited by Bryceson et al (1993) in Tanzania and Ghana showed that women did most of the collection and transportation of firewood in rural areas (figure 5.3).

It was with this assumption in mind that the author went to the field. Contrary to expectation, it was discovered that, it was, in fact, inaccurate and misleading for today's rural Ghanaian households since the field evidence as reported below shows that men and children (both male and female) did, in fact, do about an equal share of the collection and transportation of firewood, especially in Nsuta and to a lesser extent in Chamba.

Figure 5 3 Rural household transport in Tanzania and Ghana

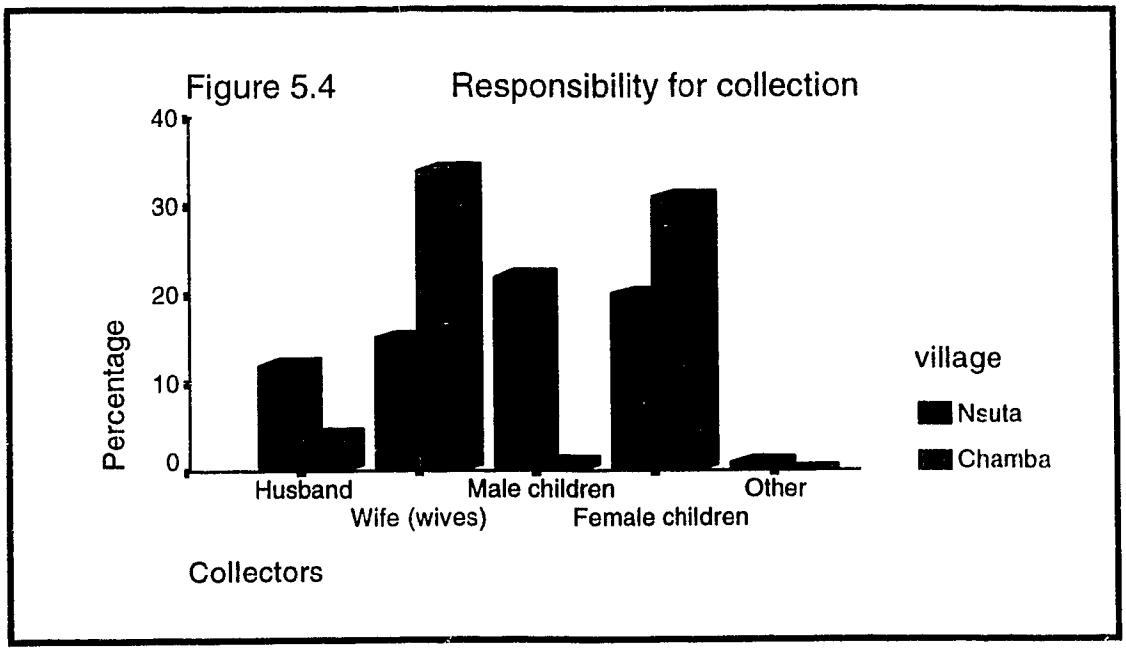


Legend

A. External marketing	F: Crop harvesting
B Trips to market	G: Crop weeding
C Grinding mill	H Crop establishment
D Health	I: Firewood collection
E. Internal marketing	J: Water collection

Source. Barwell et al (1987) and cited in Bryceson et al (1993)

Multiple answers were given by most of the respondents on the question of responsibility for the collection of firewood. This was mainly because more than one person was usually responsible for this household task.



Source: Fieldwork, 1995

As depicted in figure 5.4, in Nsuta, 15 of the 35 respondents (making up about 43%of the total respondents) said wives took part in the collection of firewood. Twenty-two of the 35 respondent households (63%) reported that male children took part in this task. About 34 per cent of the respondents reported that husbands took part in the collection of firewood. For the percentage of households that reported female children taking part in this task, the figure is 57 per cent. An insignificant 2.9 per cent reported that they had hired help in the collection of firewood. By taking part, the author is referring to

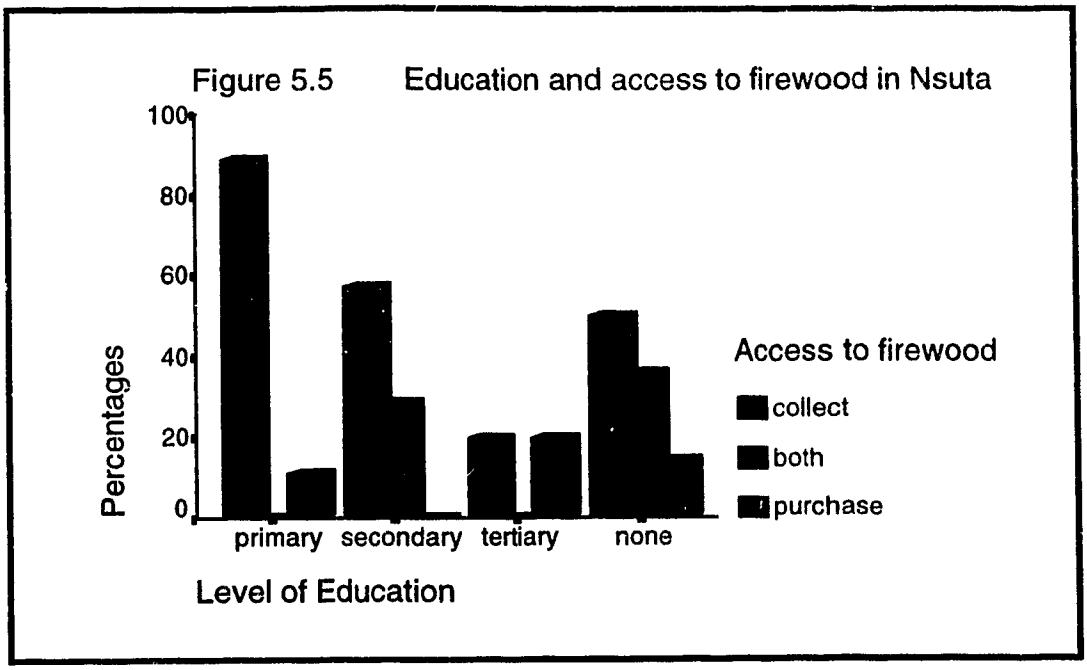
the actual collection in the field as well as head portage or by bicycle from the field to the home.

Quite the opposite is the case with Chamba. Here, all the respondent households reported that the wife (or wives) took part in the collection of firewood. Second in order of importance in the collection of firewood is the female child. About 89 per cent of the respondent households reported that female children took part in the collection of firewood. Interestingly, husbands play a very small role when it comes to this task. Only 11 per cent of respondents reported any participation in the collection of firewood by the husband. Even more interesting is the case of the male child. Unlike Nsuta, where the male child was the principal person responsible for the collection of firewood, here, the male child's contribution is almost negligible. Only 2.2 per cent reported that the male child took any part in this task.

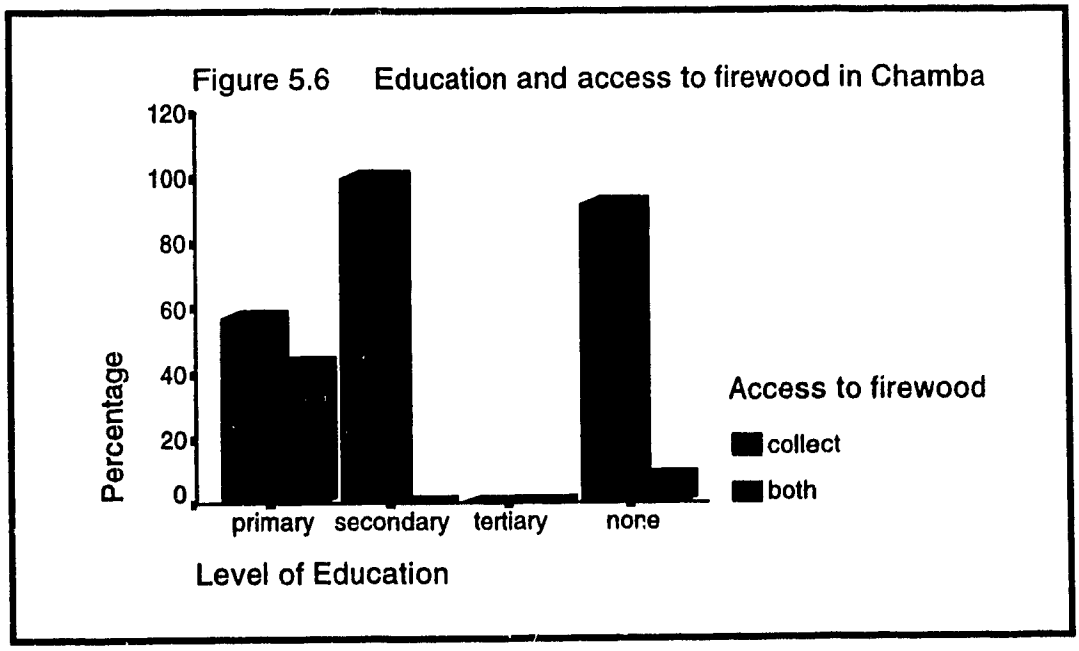
The above suggests that in Nsuta, the primary responsibility for collection falls on children in the household. But even here the responsibility is more with the male than the female child. Another observation is that here, the responsibility for collection is much more distributed. In Nsuta the man, the woman and the children, both female and male took prominent roles in the collection of firewood. This is not the case in Chamba, where the main participants are wives and female children.

5.7 Education and Type of Access to Firewood

Figures 5.5 and 5.6 show the types of access to firewood and their relationship to level of formal education in the two study areas.



Source: Fieldwork, 1995



Source: Fieldwork, 1995

One thing that is clear in the figures above, especially in Chamba is that the level of education has a bearing on which type of woodfuel is used in the household. In Chamba, none of the respondents with tertiary education used firewood at all. They preferred to use charcoal. Comparing the two villages, there is a marked difference in the type of access to firewood. For instance, of the total respondents that have no formal education, 50 per cent collected their firewood in Nsuta. The rest was divided between those who purchased (14 per cent) and those who used a combination of the two (36 per cent). This contrasts with Chamba, where an overwhelming 92 per cent reported access collecting and only 8 per cent used a combination of both methods. Here, none of the respondents reported any exclusive use of the modern method of access.

When we look at the figure for those who have primary education (2 -7 years), we see that 89 per cent of those in Nsuta reported collecting their firewood. The rest (11 per cent) purchased their firewood. In Chamba on the other hand, only 43 per cent of the respondents in the same category collected their firewood. The rest in this category in Chamba purchased their firewood..

Moving on to those who have some secondary education, about 57 per cent of them in Nsuta collect their firewood. Of the rest, 29 per cent use a combination of both. Compared to this, in Chamba, all those with secondary education purchased their firewood. In this category, none of the respondents in Chamba relied either on the traditional method of access or on a combination of the two.

Finally, of all those respondents with post secondary education, 20 per cent of them relied on the traditional method of access, another 20 per cent on the modern

method and the remainder (60 per cent) did not use firewood at all. In contrast, the lone respondent in Chamba with post secondary education did not use firewood at all.

A few points are raised concerning the above. It is clear that there is some relationship between the level of formal education and the type of access to firewood in the two societies. It is also clear that the relationship is stronger in Chamba than Nsuta, because a change in the educational status of someone in Chamba is more likely to bring about a change in the type of access than in Nsuta.

To buttress the point made by the descriptive analysis above and to give more statistical relevancy to the analysis, the study employed correlation analysis technique to establish the degree of statistical relationship between the level of education and the type of access to energy for domestic use. Using the null hypothesis that there is no relationship between the level of education and the type of access to energy for domestic use, we try to prove whether in fact there is no relationship at all. Since the type of domestic energy used is ranked in order of preference, using the people's own perception, the use of Spearman's rank-order correlation technique is appropriate to provide this insight.

$$r_s = \frac{1 - 6ED^2}{N\,(N^2-1)}$$

r_s represents the rank order correlation coefficient.
D represents the rank difference between x and y variables.
N represents the total number of cases

The analyses of the results reveal that there is a positive relationship between the two variables. For Nsuta, we have a correlation value of .4288 at a significance level of

.005. This allows us to reject our null hypothesis in the case of Nsuta. Chamba reveals similar results. Here, we arrive at a correlation value of .3719, significant at .014.

5.8 Those Who Purchase Their Firewood

The above constraints to the traditional access to firewood have made it necessary for some people, even in the rural areas, to start looking at the possibility of purchasing firewood on the market. A significant percentage of the rural people now resort to buying firewood to meet their energy requirements in the household. It was assumed before the fieldwork that all rural people readily got their firewood from the bush and their farms. It is therefore one of the significant revelations of this study. This section examines some of the characteristics of those who purchase all or some of their firewood to meet their energy requirements.

As seen in section 5.5 of this chapter, about 11 per cent of the respondent households in Nsuta reported that they met all their firewood needs by purchasing. None of the respondents in Chamba reported this. This seems, at first glance, not normal since there was more time and energy put into the collection of firewood in the north than in the south. However, factors other than the above may be determinant in the decision to purchase firewood. One of the reasons for the purchase of firewood may be lack of time due to other responsibilities like government employment. Another might be social status like higher education which comes with some regular source of monetary income. This makes it easier for a family to decide to purchase firewood not so much because they have not got the time to collect, but because it is cheap and they can afford to pay for it.

It is also clear from the introduction that 20 per cent of the respondent households in Nsuta and 14 per cent in Chamba meet part of their energy requirements by purchasing firewood. This group includes those who purchase to sell (which is discussed in the next chapter).

5.8.1 Quantity of Firewood Bought

For the respondents in Nsuta who purchased some or all of the firewood required to meet their energy needs, each household purchased between three and six head loads of firewood weekly. There was a problem in the field on the best way to measure the weight of firewood respondents reported to have bought. Several suggestions and methods were considered. In the end, it was decided to get the average size of a head load of firewood for each of the two settlements so that in interviewing respondents, we don't have to worry about carrying scales to measure firewood at the homes of respondents. One motivation was an observation made early during the field work - that the sizes (in appearances) of most of the head loads of people carrying firewood from the farm and bushes had an approximate weight. Another observation was made when several firewood selling points were visited. Here, it was realised that firewood was arranged in orderly piles of average sizes. It was therefore decided that it would be better to measure some head loads of firewood both directly from those who were carrying it from their farms and also from those selling it.

There was a slight variation in the weight of firewood carried by people from the bush and farms comparing the two villages ' e average weight in Nsuta was 37 kgs, with

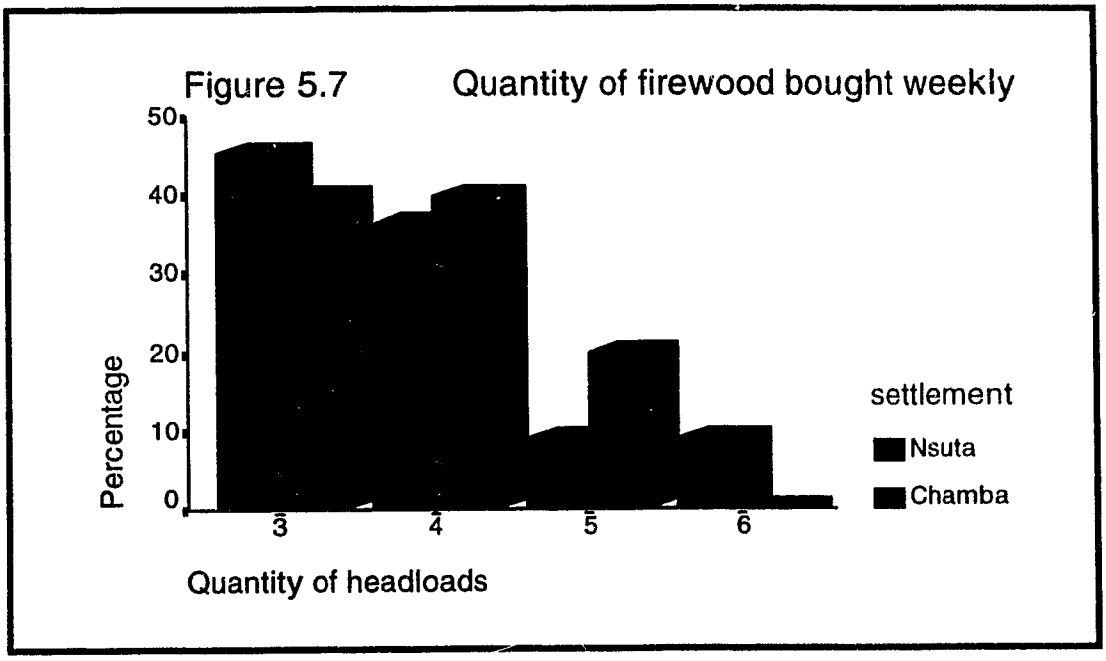
a median weight of 39 kgs and the range from 30 to 45 kgs. In all about 28 head loads were measured within a period of three days. In Chamba, the average weight was about 41 kgs, with a median weight of 42 kgs and the range from 32 to 47 kgs. In all, about 25 head loads were measured in Chamba. To be sure that we were on the right track, we did a sample of five head loads in the near by village of Taali, where we realised an average weight of 40 kilos. With regard to the selling points, random sampling revealed a mean weight of 36 kilos in Nsuta and 40 kgs in Chamba.

Using the above weights as a yardstick it is then easier to compute how much those households which bought some or all of their firewood actually bought at any given time. In Nsuta, the number of head loads of firewood bought by any household ranged from three to six. About 45 per cent of the respondents who bought some or all of their firewood requirements bought about three head loads per week. About 36 per cent bought four head loads per week, and about 9 per cent each bought five and six head loads weekly.

In Chamba, the percentage of respondents who purchased three head loads per week was about 40 per cent. Another 40 per cent bought four head loads weekly and the remainder, about 20 per cent purchased about five head loads weekly. It must be stressed that this was an average of what they bought. Most of the respondents said their purchases are not the same every week. They mentioned some of the factors that determine how much firewood they buy at any particular time. Some of these are summarized.

One of the factors is what time of year it is. This was particularly important because the food that was cooked usually depended on the season. That apart, during the

planting and harvesting seasons, most farming households spend most of the day on the farm, thus cooking very little at home during the afternoon. At this time of the year, the main meals cooked are the evening meal and some light breakfast for the children. Most of the adults either buy food outside the home in the mornings, or wait to eat on the farm.



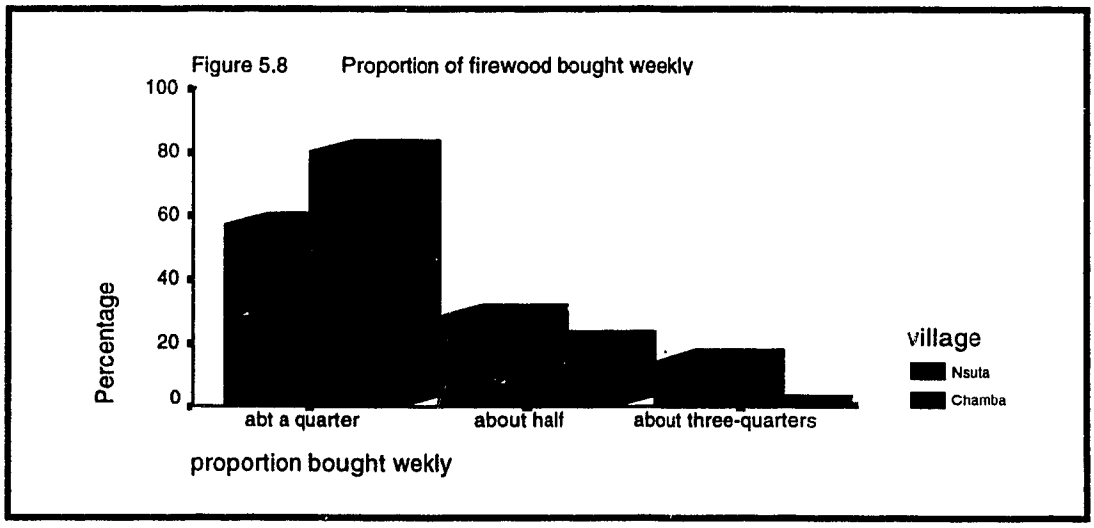
Source: Fieldwork, 1995

Another reason why the time of year is important is that during certain periods of the year, firewood is easier to get. During this time, firewood is cheap. This means that most households would normally be buying more than they can actually use in the short term. In doing so, these households would be stockpiling firewood for later use.

Another factor that determines the quantity of firewood that any household purchases at any one time is the availability of secure storage space. Those who have

storage, preferably within the compound, would normally buy more than they need during the dry season, when it is easier to get dry wood to cut in the bush. During this period, because it is cheap, most households who rely on the market to meet their firewood requirements, would stockpile firewood for later use. A few respondents indicated that they did not stockpile because they had no safe storage space.

For those who meet their firewood requirements by supplementing what they gather by buying some on the market, figure 5.8 represents the proportions they bought. In Nsuta, 57 per cent buy about a quarter of their firewood, about 29 per cent buy about half of their firewood requirements and the remaining 14 per cent buy about three-quarters of their requirements. In Chamba, about 80 per cent buy about a quarter of their requirements and the remaining 20 per cent buy about half of what they need to meet their energy needs.



Source: Fieldwork, 1995

5.9 Sources of Charcoal Supply

In rural areas, even though the majority of the people rely on firewood for their energy needs, a growing proportion of them now turn to charcoal either as their main source of energy for domestic activities, or to supplement what they get through the use of firewood. It was apparent from the field that most households which used charcoal in the two study areas, used it to supplement their firewood energy. One of the reasons respondents gave for the use of charcoal was that it produced less smoke compared to firewood. Another reason was that it was easier to handle, transport and store. Most of them conceded, however, that it was more expensive and only economical for small households. This emphasises the fact that exclusive charcoal users are mainly small households. It is therefore important to note that all the households which used charcoal for all their domestic needs were small (comprising the woman, the man and one to three children).

Table 5.6 Use of charcoal in the two study areas

Village	Always	Sometimes	Not At all	Total
Nsuta %	20	28.6	51.4	100
Chamba %	5.7	48.6	45.7	100

Source: fieldwork, 1995.

From table 5.6, it is clear that the proportion of the people who are exclusive users of firewood is higher in Nsuta than in Chamba. Whereas only 5.7 per cent of the respondent households in Chamba reported the exclusive use of charcoal, about 20 per

cent of the respondents in Nsuta reported this. When it comes to those who sometimes use charcoal, the reverse is the case. Among those who sometimes use charcoal, Chamba recorded a high figure of 48.6 compared to only 28.6 per cent in Nsuta. That means that more people in Chamba rely on charcoal as a supplement for firewood than in Nsuta. Nsuta reported 51.4 per cent not using charcoal at all compared to 45.7 per cent in Chamba.

5.9.1 Source and Quantity of Charcoal Bought Weekly

Table 5.7 highlights the source of charcoal used in the household by those who reported the use of charcoal to meet all or part of their domestic energy requirements.

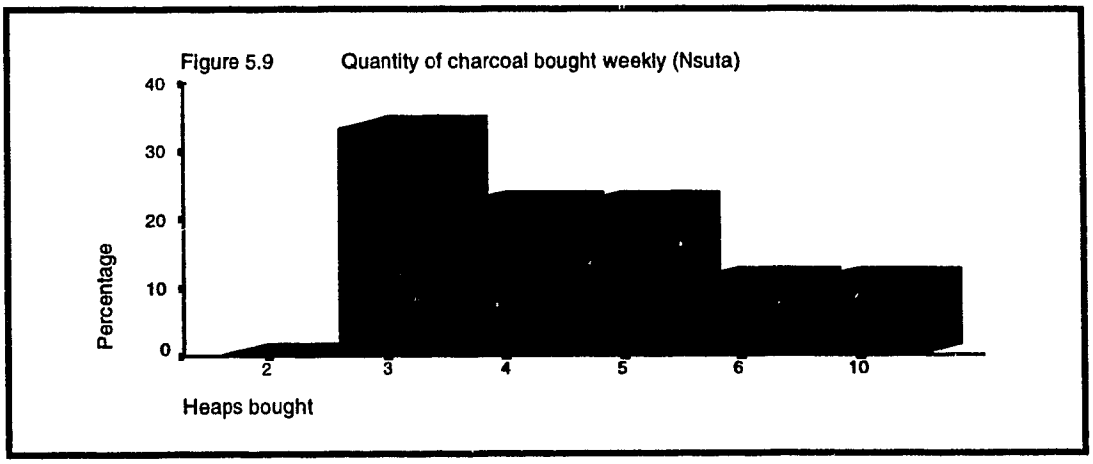
Table 5.7 Sources of charcoal used in the household

Village	Leftovers from using firewood		Buy from the Market		Total	
	no.	%	no.	%	no.	%
Nsuta	8	47.1	9	52.9	17	(100)
Chamba	17	89.5	2	10.5	19	(100)
Total	**25**	**69.4**	**11**	**30.6**	**36**	**(100)**

Source: Fieldwork, 1995

For those who reported the purchase of charcoal to meet part or all their domestic energy requirements, 52 per cent in Nsuta and only 10.5 per cent in Chamba purchased their charcoal requirements. This means that as many as 89.5 per cent of the respondent

households in Chamba which do use charcoal got their charcoal as leftovers from the use of firewood. In Nsuta, those who use the leftovers from the use of firewood to meet their charcoal requirements are 47.1 per cent of charcoal users.



Source: Fieldwork, 1995

During the surveys, it was realised that whereas respondents in Chamba bought charcoal in large pans (of about 20 kilos) at a time, those in Nsuta normally bought small heaps of about 5 kilos at a time.[2] Nine people reported buying some or part of their charcoal requirements in Nsuta. Figure 5.9 shows the quantities of charcoal bought in Nsuta. Of those who reported purchasing some or all their charcoal needs in Nsuta, about 33 per cent bought three heaps per week, a further 22 per cent each bought four and five heaps weekly. Of the remaining respondent households which bought some charcoal, one

[2]In order to be able to compare effectively the two villages, it was necessary to convert the measures of Chamba to those of Nsuta (from the large pan figures to small heaps). So that, for example, if one claimed to buy a pan of charcoal to last for say four weeks, it means the person uses a quarter of a pan or five kilos (equivalent to one heap in Nsuta) per week. This way, we have one unit of analysis.

bought six heaps per week and one bought 10 heaps per week. In Chamba, the situation is different. Here, only two people claimed to buy charcoal. One of them bought only two heaps per week and the other three heaps per week.

5.10 Charcoal Production

Households which do not use large quantities of charcoal and which use large quantities of firewood, can easily gather enough charcoal to meet their charcoal requirements. This is done by extinguishing the fire immediately after use. By doing so, the part of the firewood that has been carbonised but not burnt to ashes is gathered and stored to be used as charcoal at a later date. In order to be able to do this, the wood species should be of a type that lends itself to easy carbonation.

Commercial charcoal production is mainly by the earth-mound method, especially in rural areas. In some bigger towns, the steel kiln is becoming increasingly popular, especially in parts of Ashanti and Western Region (Nkansah, et al, 1988). In the two study areas, efforts were made to identify and contact some commercial charcoal producers. A number of charcoal producing groups were located in Sekyere West District with the help of Mampong Charcoal Dealers Association, an interest group of people engaged in the sale of charcoal in Mampong and surrounding areas.

There being large commercial production in Nsuta, the village of Jediako, northwest of Nsuta was selected for study. Here, it was discovered that charcoal production was done in groups of between six and 12 people, called gangs. Several factors determined the size of the group, including the intensity of their activities and the season.

There were some gangs that were formed along family lines. Most gangs were made up of young men between the ages of 16 and 29 years. A few commercial charcoal producers were identified in the Nanumba District in the Northern Region as well. Only one person was identified as a commercial charcoal producer in Chamba, but in the adjacent village of Sabonjida, three brothers were engaged in very large scale commercial production of charcoal. Here, it was mainly a family business, with little help from outside the family. They estimated production at between 10 and 25 bags of charcoal per week, depending on the season. Each bag weighed about 40 kilograms. There were, however, some bags which weighed as much as 57 kilograms and some as light as 32 kgs.

There are several ways charcoal producers are organised. One method was for a very experienced charcoal producer, usually an old man, to form a gang and leave the day to day functioning of the gang to the young men, with himself remaining as an overseer or director. Another method was for several independent people to cooperate as a gang. This is done by offering labour in various parts of the production process with the various members receiving production turns. The producer being helped is required to provide food and drinks for the gang.

In the case of the formal gangs, where members pool their resources to produce and share profits, the leader of the gang does all the business contacts with prospective buyers, transporters, and tax authorities to ensure favourable terms on behalf of the group. In the Ashanti region, before they can start felling any trees, the leader of the gang procures a permit from the village chief, Lands Department or the Department of Forestry. This permit is the certificate that entitles them to fell trees in some particular location.

Commercial charcoal producers interviewed in Chamba and Sabonjida said they did not need a permit to start felling any trees. But conversations with the District Forestry officials in Bimbilla, the District Capital revealed that a permit was necessary, but complained that with very limited means of transport, it was not possible to monitor the activities of these charcoal producers.

5.11 Summary

This chapter has dealt with the issue of types of access to firewood and charcoal for domestic use in Nsuta and Chamba. Based on the findings of this chapter, it is clear that the majority of rural households still rely heavily on collecting firewood to meet their energy requirements. However, it has been revealed that there are increasing constraints of time and labour among others. These constraints have led a section of the population to resort to other means to get firewood. These include either buying some firewood or charcoal to supplement what they can collect on their own to outright purchasing of all their firewood requirements. It is also apparent from this chapter that a section of the population in rural areas use charcoal to meet part or all their domestic energy requirements. One significant revelation is that there has been a very strong relationship between the level of education and the type of access to domestic energy in the two study areas. The next chapter examines the woodfuel use patterns in the two villages.

Chapter Six

Woodfuel Use Patterns in Sekyere West and Nanumba Districts

6.1 Introduction

The types of uses to which energy is put depend to a large extent on the level of socioeconomic development of the people. Chapter five dealt with woodfuel supply and access patterns in the two selected villages. The chapter revealed that rural households relied mostly on the collection of firewood for domestic as well as commercial activities. The chapter also revealed that a small, but growing proportion of rural households now resort to purchasing fuelwood to meet all, or part of their energy requirements. This chapter takes the study a step further by concentrating on woodfuel use patterns in a rural setting, using the two selected villages.

In line with the growing proportion of rural households which purchase fuelwood, a section of this chapter assesses the sale of firewood and charcoal in the two villages and how this is affecting the rural household economy. In this respect, this chapter also examines the motivation behind the sale of these fuels, for how long rural households have been engaged in this activity and also the wider implications of this growing trend. The use of other sources of energy, like kerosene and LPG is also examined in this chapter. There are some uses to which, in theory, firewood is not the only option available. But practically, households in rural Ghana have very little choice when it comes to what source of energy to use for certain activities - especially those that require large amounts of energy. Since this study concentrates on rural Ghana, it will, of necessity, focus more on rural fuels - firewood and charcoal.

6.2 The use of firewood

Table 6.1 illustrates the uses to which firewood is put in the two villages. Among the uses highlighted in the graph are domestic and commercial cooking, heating, lighting, for sale and finally other uses.

Table 6.1 Household uses of firewood

Use of Firewood	Nsuta	Chamba
Domestic cooking	31	34
Commercial cooking	6	5
Heating	3	11
Lighting	-	1
For sale	8	12
Other	2	-
Total Responses	**50**	**63**

Source: Fieldwork, 1995 (Multiple responses were recorded)

As can be seen on table 6.1, the major uses to which firewood is put in the two villages is domestic cooking. It should be pointed out that all the responding households which use firewood reported multiple uses. All the 31 respondents in Nsuta who use firewood (making up 81.6 per cent of total respondents) answered that they use firewood for domestic cooking. But they also used firewood for other activities as well. Six households (17 per cent of the total respondents) used firewood for commercial cooking. Further questions revealed that these are, mainly, those who sold cooked

food, processed food items and other agricultural products (like palm nuts) into palm oil, and alcoholic beverages (particularly "pito"[3]). A further 3 households (8.6 per cent of the total respondents) reported using firewood for heating the home and rooms and a further 2 households (5.7 per cent) reported using firewood for other activities, including artisanship. The table also shows that 8 households (23 per cent of the respondent households) in Nsuta sell firewood, (considered under section 6.4).

In Chamba, all 31 respondents who use firewood (making up about 91.1 per cent of the total respondent households), reported using firewood for cooking. Like Nsuta, they also reported using firewood for other activities. For instance, 5 households (14.3 per cent) in Chamba reported using firewood for commercial cooking, 11 households used firewood for heating and one household used firewood for lighting up the home. It is also clear from the table that 12 households (34.3 per cent) sold firewood.

6.3 Why firewood is preferred for cooking.

Just as kerosene is the preferred energy for lighting the home (6.8), firewood is the preferred energy for cooking. Even in Nsuta, where electricity is available, none of the respondent households reported using electrical stoves for cooking. Figure 6.1 represents the explanations of the households in the two villages for why firewood is preferred for cooking.

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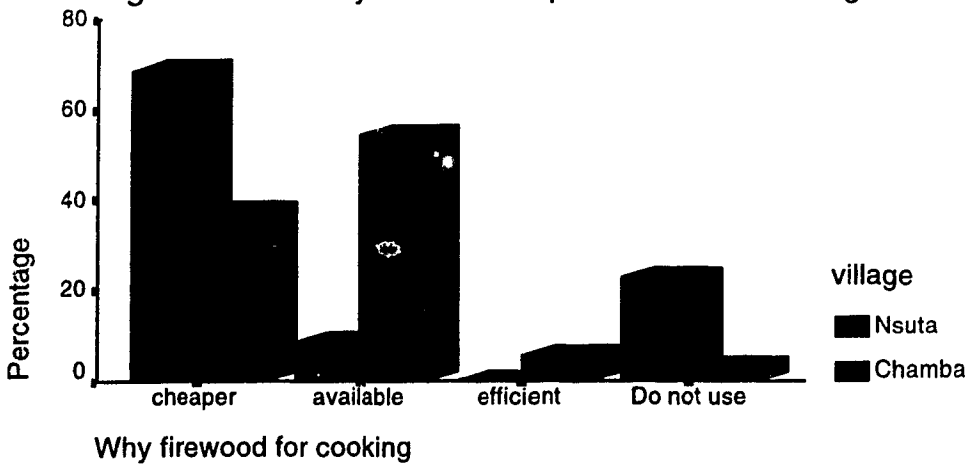
[3]Pito is an alcoholic beverage mainly produced in the north. But migrant settlers in most southern towns and villages have started brewing for sale. The market target was originally the migrant population, but the resident population now patronise these Pito bars. The main cereal used is guinea corn (sorghum).

Figure 6.1 Why firewood is preferred for cooking



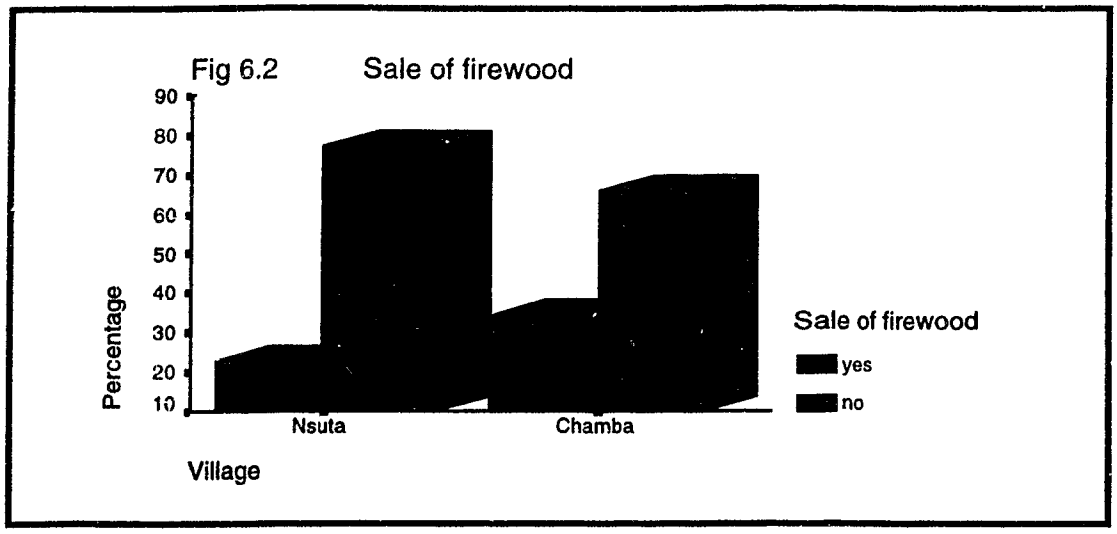
Source: Fieldwork, 1995

Among the reasons given by the respondents in the two villages, the fact that it is free and also available are the main ones. In Nsuta, as many as 69 per cent of the respondent households reported that they used firewood because it was the cheapest fuel available. Only 9 per cent of the respondent households reported using it because it was available and none of the respondents reported using it for efficiency reasons. The reasons explanations for respondents' responses in Nsuta lie be seen in their frustration in not being able to use electricity for all their energy needs. Most of the respondent households would have preferred to use electricity for cooking and to satisfy their other energy needs, but due to the high cost of electricity and the equipment necessary to use the electricity, the people used firewood, not so much because they liked using firewood, but because they could not afford the other alternative.

On the other hand, residents of Chamba mostly reported using firewood because it was the only available alternative. About 54 per cent of the respondent households reported using firewood because it the available fuel. These see firewood as their only realistic choice since they do not know when in the near future electricity would be made available to them by the government. A further 37 per cent of the respondents reported using firewood because it was cheaper and 6 per cent because it was efficient.

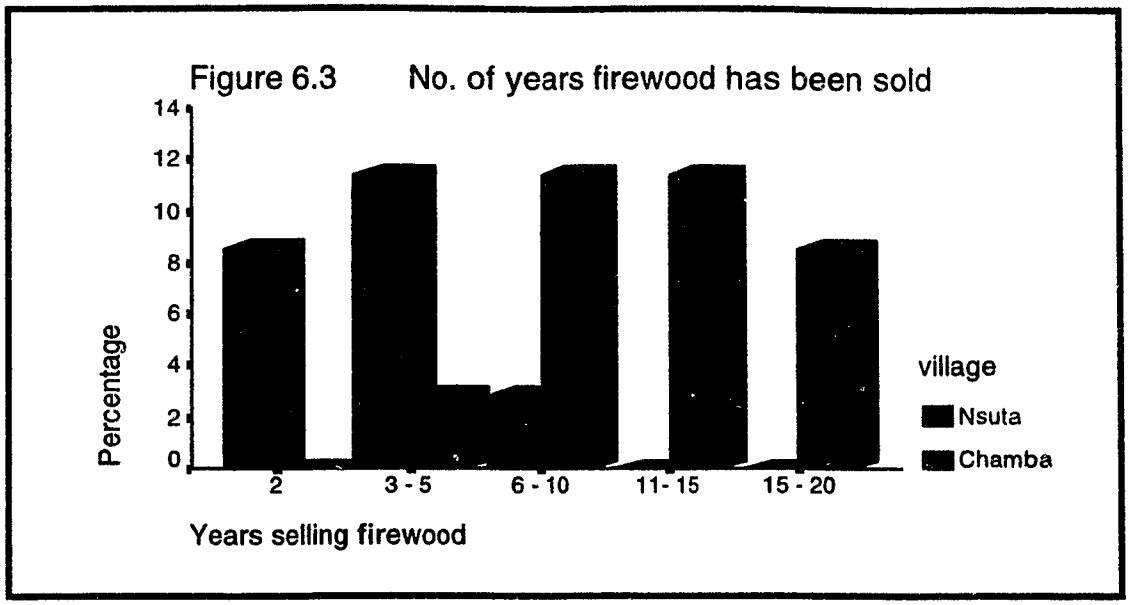
6.4 The sale of firewood

It is apparent from table 6.1 that firewood is the dominant source of energy in the rural household in Ghana. As mentioned earlier in the introductory chapter, the author had assumed that all rural households got their firewood from their farms or the bush. Observation in the field as well as analysis of the questionnaire has proven that a growing proportion of rural population now meet their firewood needs by purchasing on the market. In this section, the author will analyse some of the patterns that are apparent in the study areas pertaining to firewood sales and related issues.



Source: Fieldwork, 1995

As can be seen from figure 6.2, about 23 per cent of the respondent households in Nsuta and 34 per cent in Chamba reported selling firewood as a source of supplementary income. It should be pointed out however that two respondents in Chamba reported that firewood sales accounted for more than half of their annual incomes. When asked how long they have been selling wood, the respondents in Nsuta reported selling firewood for between two and five years. This contrasts sharply with Chamba where most of the respondents who sell firewood have been doing so for between six and twenty years (figure 6.3). This reflects difference in availability between the two areas. Deforestation in the savannah areas has been going on for a much longer time compared to the forest region in the south.



Source: Fieldwork, 1995

6.5 The uses of charcoal

Various studies have shown how charcoal is preferred as the principal source of household energy in Ghana. Without access to land to harvest firewood and firewood being cumbersome to transport and store, charcoal seems a much more attractive alternative. However, in a rural setting, where access to land is guaranteed, the question arises why any household would prefer to use charcoal at the expense of firewood. This section seeks to assess household charcoal use patterns in Nsuta and Chamba. It also seeks to identify the changes that are taking place with deforestation and better/higher formal education as well as changes in the socioeconomic status of households and how these affect the use of charcoal.

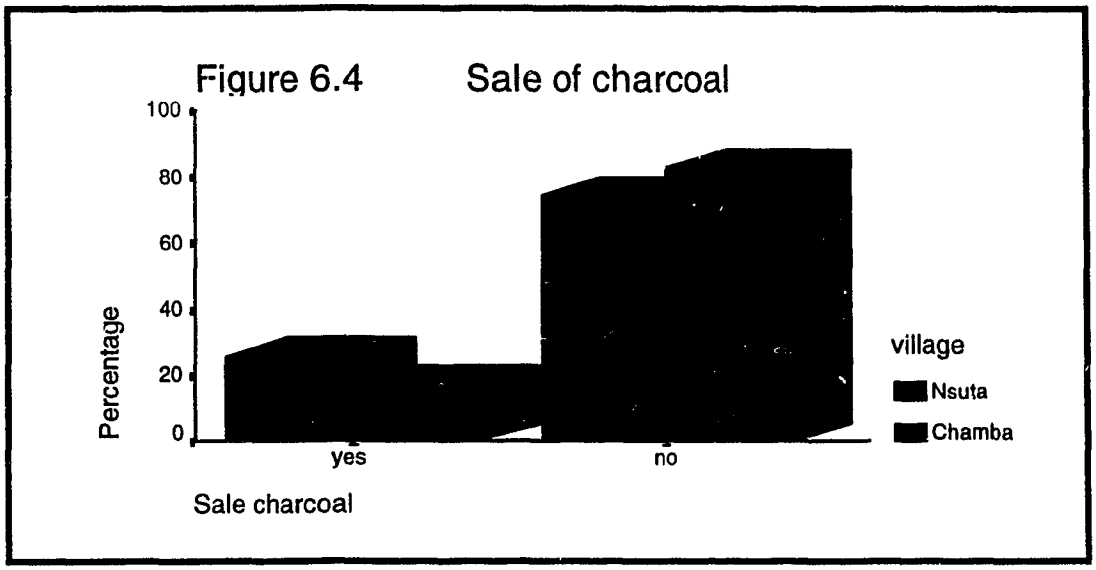
Charcoal is primarily a secondary cooking fuel in the two rural settlements. In both settlements, it is not widely used as fuel for commercial activities, such as "pito" brewing. One of the principal reasons why charcoal is generally used only as a secondary fuel is its high cost. Unlike firewood, which can be got from the bush or the farm, before one uses charcoal, one has to first get firewood and go through the carbonation process, which can be time consuming. Another issue is that the technology for charcoal making is not very widespread, and is dominated by certain ethnic groups in the rural areas. The majority of commercial charcoal producers in the south are even migrants, mainly of the Sisala ethnic group of North Eastern Ghana. Finally, even if the technology is available, time and labour is required to convert wood into charcoal before it can be used.

Despite charcoal being mainly a supplementary household fuel in the rural areas, some craftsmen, particularly gold, silver and blacksmiths prefer charcoal to firewood. This is mainly because charcoal produces less smoke, is easier to handle and is more compatible with the types of equipment used. A few small scale food sellers also use charcoal in preparing their food in the two settlements. These include those who sell fried plantain, eggs and roasted yam and corn on a small scale.

The main equipment required for the use of charcoal is the "coalpot", which has a conical metal top mounted on a cylindrical base with an opening to allow air circulation. The charcoal is put in the conical top, lighted, and the opening in the cylindrical base is fanned to turn the charcoal into red-hot coals on which the food to be cooked or heated is put. When cooking is done, the fire is put out by sprinkling

water on the hot coals. The coals are separated from the ashes and are used again. Coal pots are made by local craftsmen and are readily available on the market.

As can be seen from figure 6.4, 26 per cent of the respondents in Nsuta and 17 per cent of the respondents in Chamba reported selling charcoal to augment the household income. The majority of the charcoal sold was to the residents of the village, some is sold in larger towns during market days.



Source: Fieldwork, 1995

6.6 The use of other energy sources

Despite the heavy reliance on firewood and charcoal for most of the domestic and commercial activities in rural areas, other sources of energy are also used. In the two villages, some of these other alternative energy sources like solar energy are not

readily quantifiable, whereas others like kerosene and diesel can be quantified. This section will examine some of the alternative energy sources in rural communities. Even though solar energy is used in practically every household in the two villages, it is difficult to quantify or measure the quantities of solar energy used. Generally, solar energy is used in a wide variety of activities, including the drying of crops, meat, fish and laundry. The next few sections will examine some of the uses to which alternative energy sources are put in the rural community.

6.6.1 Milling of grains

Milling of grains is a major activity in rural communities in Ghana. It is especially important in northern Ghana where most of the diet is of cereals and grains. Milling was identified as an important activity in the two communities, and more especially in Chamba, where the main staple is Tuo Zaafi (prepared from milled cereals, like maize or sorghum), which requires a lot of grinding. Traditionally, grains are ground on grinding stones. This method wastes both labour and time. In recent years, diesel-powered grinding mills have been introduced, which take care of the grinding needs of whole communities. These grinding mills are owned by private citizens and customers are charged by the quantity of grains milled.

The first grinding mill was established in Chamba in 1985 by a rich farmer with assistance from relatives in the city. Since then, three more have been established, even though two are currently inoperable due to poor maintenance and spare parts' problems. These mills cater to the needs of not only the residents of Chamba, but also

those of surrounding villages, who usually come on Fridays, Chamba's market day, to mill their grains. The mills are mainly used to grind grains and other food items like peanuts (into peanut butter) and shea nuts (into shea butter pulp, from which shea butter is made). A couple of the respondents in Chamba reported using the traditional method in grinding their grains.

At the moment, Nsuta has no grinding mill. The only grinding mill in Nsuta broke down a couple of years ago and has not been repaired. As a result, the residents do all their milling at Mampong, the district administrative capital, about 5 kilometres away. Because the staple here is mainly pounded cassava and plantain or cocoyam (called fufu[4]), grinding is not as central to the people as it is in Chamba. Occasionally, however, when a household wants to eat some other diet, like kenkey, or banku, then they have to get to the mill. With the exception of grinding small quantities of pepper, dried okra and tomatoes, which is done manually with the grinding stone, all major milling is done at the grinding mill.

6.6.2 Using petroleum products in agriculture

Farming constitutes the major activity undertaken in both Nsuta and Chamba. Overall, farming is more labour intensive in Nsuta than in Chamba. Residents of Chamba tend to use tractors more in their farming activities. Here, farm sizes and

4 Fufu is the chief meal of the Ashanti people of the forest region in Ghana. It is prepared by pounding boiled cassava, plantain and/or cocoyam and eaten with a variety of soups, including palm nut, peanut butter soup, and egg plant soup

yields constituted one major criterion in establishing wealth ranking. A few residents used animal traction - mainly bullock ploughs in the tilling of the land in Chamba. The main fuel used in the use of tractors in Chamba and to a lesser extent, Nsuta, is diesel. A petroleum products retail outlet was identified in Chamba. This was owned and operated by a migrant from southern Ghana. Discussions with residents reveal that supplies were erratic and prices were exorbitant. As a result, most residents who employed the use of tractors preferred to buy the fuel from bigger towns like Bimbilla or Salaga.

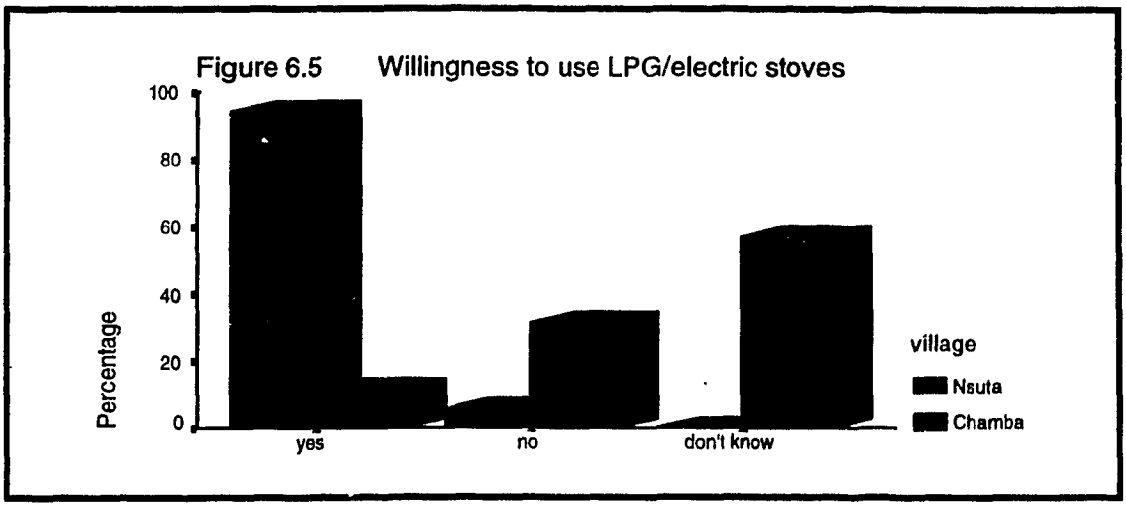
Tractors are seldom used in ploughing in Nsuta. This is due to several factors, including the fragmented nature of land holding, the forested landscape and rugged terrain. On the other hand, tractors are easier to use in the north because of the vegetation - savannah with few trees and larger land holdings.

6.7 Choosing an Energy Type

Several factors influence any particular household in their choice of which fuel to use. The two most important factors that would account for the shift from the traditional source of biomass energy to modern commercial fuels are accessibility and affordability. First, the household must be secure in the knowledge that there would be access to dependable supplies of the type of fuel they choose to use in the foreseeable future. Second, they need sufficient income to invest in the devices for using them. This includes also the accompanying user-fee and maintenance costs that come along with them (Leach, et al, 1988). In rural economies such as those of the two study

villages, the majority of the people are subsistent farmers, who have very little cash income. For the two villages, one of the factors investigated was the willingness to use alternative sources of energy for domestic purposes.

It was found that there was a very significant difference in the perception of the people when it comes to their willingness to shift to alternative sources of energy. When the question of willingness to use liquefied petroleum gas or an electric cooker was asked in the two villages, very different answers were given. For example, as illustrated by figure 6.5, an overwhelming 94 per cent of households in Nsuta were willing to use stoves that were powered by LPG or electricity - that is if it were made available to them. In contrast to that, only 11 per cent of households in Chamba were willing to use LPG or electric stoves.



Source: Fieldwork, 1995

Whereas only about six per cent of the respondents in Nsuta were not willing to try any alternative energy sources, about 31 per cent of the respondents in Chamba reported this. Interestingly, in Chamba, a high percentage of 51 were not sure whether they wanted to use any alternative domestic energy sources. No one in Nsuta reported this. This was one of the findings that had to be reconciled with earlier assumptions. Because it was more difficult to get woodfuels in Chamba compared to Nsuta, the author assumed that the people who lived in Chamba would be more willing to accept the change to use better and more efficient energy sources. But as pointed out by Leach et al (1988), the reasons that account for the decision to use any particular energy source are complex.

The experience of the people of Chamba, with regard to the dependability of external sources of energy has not been good. Particularly due to bad roads and poor infrastructure, petroleum products are sometimes scarce here and people have to travel to bigger towns to acquire them. In the opinion of the people, switching from firewood and charcoal, the use of which is controlled by them, to an externally controlled energy source was a risk not many of them were willing to take. The other factor was that the whole Nanumba district does not enjoy electricity from any source. In fact, the whole of the Northern Region, the largest of the ten administrative regions in Ghana is the poorest in terms of the provision of services like electricity.

On the other hand, even though it is easier to obtain firewood and charcoal in Nsuta, the residents here know that in the not very distant future, access to land on which to farm and look for firewood is going to be very difficult. This is because of

the high population density and the population growth rate. Currently one of the major complaints of the people is the fragmentation of land holdings when land is passed on from generation to generation. This is clearly illustrated by the words of Maame Yaa Agyeiwaa, a resident of Nsuta and one of the five people with whom informal interviews and discussions were held:

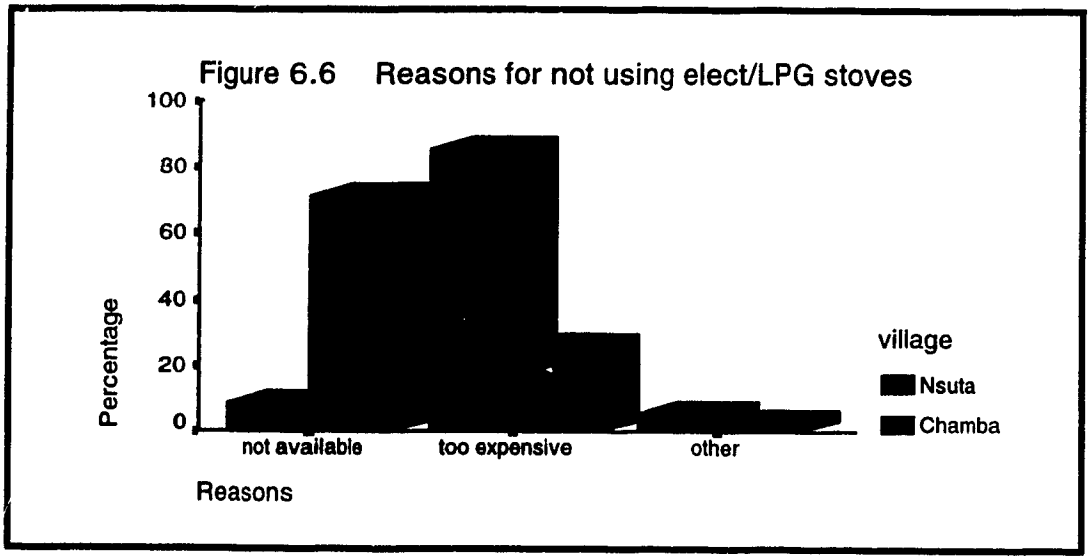
> When I was a little girl, I remember our farms to be very big ones. I remember my mother telling me that her mother had about four times the size of her plots. I know my children would have even smaller plots of land on which to farm. My prayer is that they don't quarrel over the little that I leave with them. When I go to the head of the family for more land, he says there is no more unused family land. At the moment, we have barely enough farm land. But what about the future? I pray that my children do very well in life so that when the need be, they can buy food and firewood from the market (Personal interview).

Maame Yaa's fears clearly illustrate the prevailing concerns in several parts of not only the Sekyere West District, but the whole of Ashanti. The other thing worth mentioning is the fact that there is electricity in Nsuta. The people here know the difference that a more efficient energy source can make in their lives. Adoption therefore depended on whether or not they could afford it.

The next issue was to find out the reasons why people were not using alternative energy sources even though they indicated that they were willing to use them. As illustrated in figure 6.6, the reasons given by the two villages with regard to why they do not use alternative energy sources are quite different. Whereas the principal reason given in Nsuta was affordability, Chamba respondents found it was simply unavailable.

Only nine per cent of the respondents in Nsuta gave unavailability as the main reason why they don't use alternative energy sources like LPG or electricity powered stoves in the home. In contrast to that, an overwhelming 71 per cent of those in Chamba felt that was the principal reason. The first reason for this is the ease with which petroleum products can be obtained in Nsuta when compared to Chamba. The other reason has to do with the availability of electricity in Nsuta and its absence in Chamba.

Figure 6.6 Reasons for not using elect/LPG stoves



Source: Fieldwork, 1995

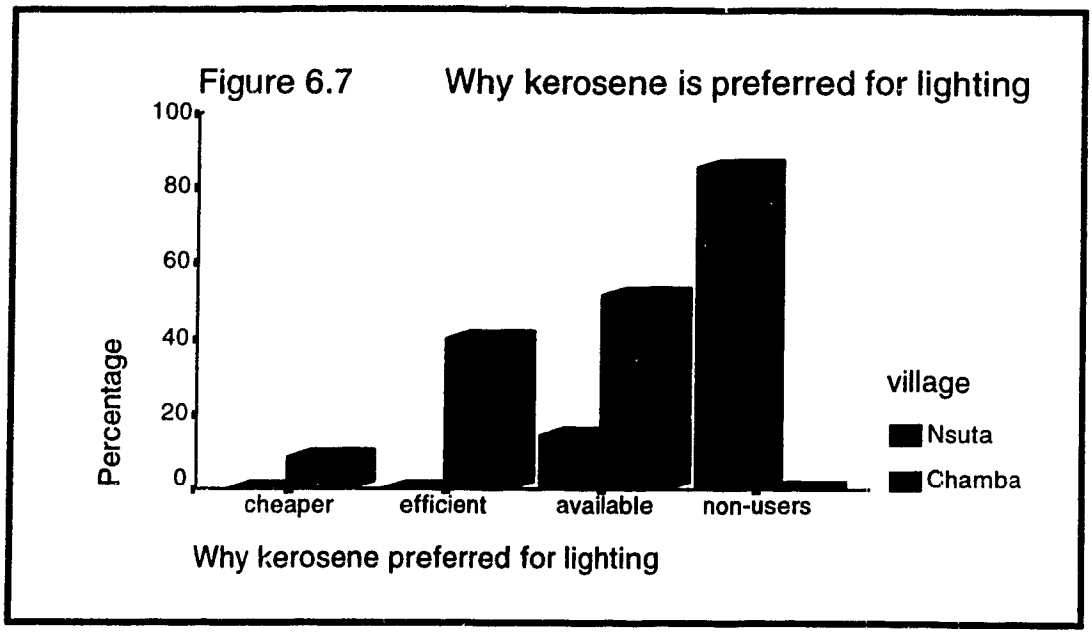
For residents of Nsuta, the question of using electricity is not availability, but affordability. On the other hand, for residents of Chamba, the question of using electricity or LPG has more to do with unavailability than affordability. Even if it were available, it is very unlikely that more than 20 per cent of the residents would be

willing to use it without some form of government subsidies. This is mainly because of the general poverty level in the district.

About six per cent of the respondents in Nsuta and three per cent of the respondents in Chamba reported other reasons for not using alternative energy sources, such as the dangers associated with the use of electricity and LPG. These respondents basically had the view that electricity was unsafe. An interesting observation was made by some of those who had this view. They mentioned that sometimes when they visited their relatives in the city they heard stories of electricity shocks, and gas leakages. On further investigation, it was observed that most of the areas visited in the cities are the slum areas where there are a lot of illegally connected households, which pose a lot of risk hazards for the Electricity Corporation of Ghana (ECG).

6.8 Why Kerosene is Preferred for Lighting

Almost all respondents in Chamba and all respondent households in Nsuta without electricity reported the use of kerosene for lighting the home in the night. The question that needed answering was why they used kerosene and not any other fuel types. The answers to that question are mainly that kerosene was the only cheap and efficient available option. The proportion of the respondents in the two villages which gave the various answers is shown in figure 6.7.



Source: Fieldwork, 1995

As illustrated in figure 6.7, none of the respondents in Nsuta and only nine per cent in Chamba used kerosene because it was cheap. This is because kerosene was not cheap to buy on the market, especially looking at it from the point of view of the residents of the two villages. Taking the cost of kerosene for an average family for a month as an example, it would be illustrative to see what that amount could have been used for. An average household in Chamba uses three bottles of kerosene a week, making it about 12 bottles a month. At the time of the fieldwork, in October 1995, a bottle of kerosene cost 350 Ghanaian Cedis (C350). The average family therefore spent about four thousand, two hundred cedis (C4200) on lighting alone per month. Converted to Canadian dollars, C4200 is just more than four dollars. But in real terms, it is a lot. For example, a 50- kg bag of maize sold at C 12000 (12 dollars)

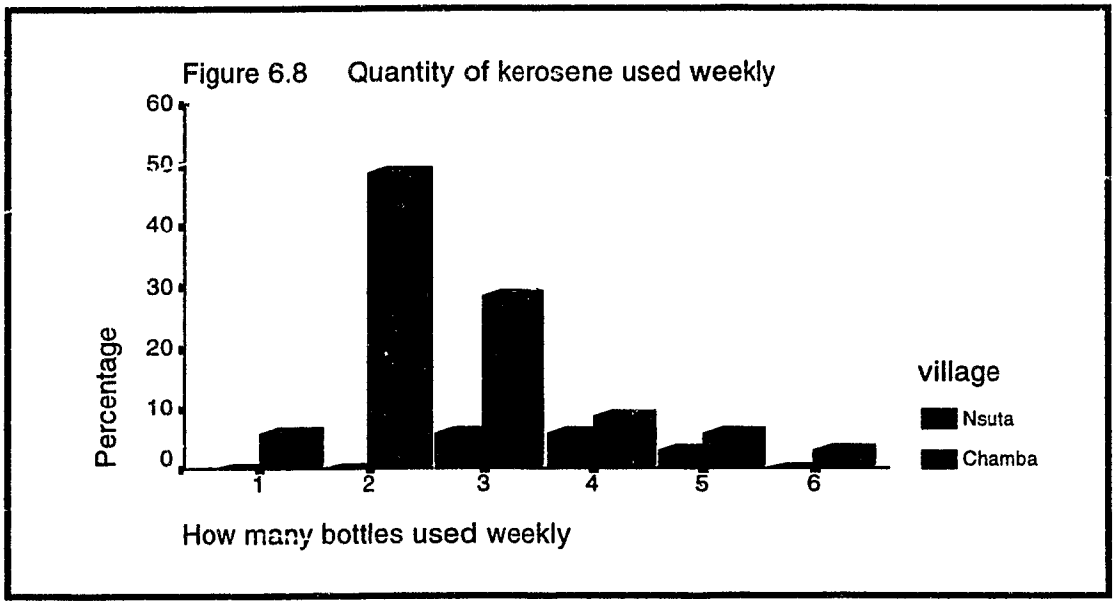
at the same time. If the family can afford to sell only 10 bags a year, then it means the family spends roughly about 30 per cent of their annual income on kerosene. Of course this is an oversimplified analysis since the family will have some income-generating activity in the form of a garden behind the house, selling firewood, preparing some food for sale or something else to make some more money.

Figure 6.7 also shows that none of the respondents in Nsuta who used kerosene, used it for efficiency reasons. However, 40 per cent of those in Chamba used kerosene because it was efficient. This is mainly because residents of Nsuta have seen how efficient alternative energy sources like electricity can be, so they know that using kerosene to light up the home is not the most efficient way of doing that. But for the respondents in Chamba, kerosene is the most efficient of the options available to them. Most of the respondents claimed they had switched from using firewood to using kerosene lamps in lighting their homes in the last five to ten years, with the relative availability of kerosene on the market. For them, therefore, using kerosene is a major step up the modernization ladder. This is not to say that they would not like to use electricity. They know that it will take several decades before their village is connected to the national grid for them to enjoy electricity.

Finally, 14 per cent of the respondents in Nsuta and 51 per cent of those in Chamba reported that they used kerosene for lighting their homes because it was available. This is interesting because, for the respondents in Nsuta, they know that they have other choices. They could use electricity to light their homes. But the problem is with affordability. For these households the presence of electricity in the town does not

translate into an energy form they can use in their homes, since they cannot afford it. For them therefore, the only available energy form is kerosene.

Figure 6.8 shows the quantities of kerosene used by the respondents in the two villages. Because Nsuta has electricity, it was assumed that every household would be connected to the system for the provision of more efficient lighting system. Contrary to that we realise that as high as 14.3 per cent (5 of the 35 respondent households) do use kerosene for lighting. That means that those households (14.3 per cent) in Nsuta are not connected to the electricity that the village is supposed to enjoy. For those who use kerosene in the household, several factors influence the uses to which it is put and also the quantity of kerosene the particular household uses at any particular time.



Source: Fieldwork, 1995

Among these factors is the size of the household. Due to the fact that kerosene is an externally controlled commodity, with the village having little or no say at all in the procurement and pricing of the product, the household has to consider how much kerosene they have to buy to satisfy the use for any purpose. In this decision making process, the size of the household becomes very important. Small households would tend to prefer kerosene for activities that require small amounts of energy, for example, heating water in the morning for tea. Another factor that determines whether a family is likely to use kerosene or not is the level of formal education of the principal breadwinner in the family. Where the principal breadwinner has some amount of higher education, the tendency to use kerosene for smaller jobs in cooking becomes greater, because, using kerosene stoves is seen as a sign of modernization.

It is clear that all the respondent households in Chamba used some amount of kerosene every week. This is because unlike Nsuta, which enjoys electricity, Chamba does not. As a result, of the options open to the residents of Chamba, the most efficient is kerosene. When asked where kerosene was obtained, most of the respondents reported buying what they needed on Fridays, which was the market day for the village. On this day, traders come from all over the district and beyond bearing goods for sale and coming to buy farm produce from the villagers. The residents of the village buy all they need for the coming week on this day, so that they don't have to travel to the nearest town, which happens to be the district capital, 30 kilometres away to buy what could have been bought on the market day.

Figure 6.8 also shows the quantities of kerosene bought in Nsuta and Chamba. In Nsuta, two households (6 per cent of the total respondent households) use about three bottles of kerosene a week, a further two households use four bottles of kerosene a week and one household use five bottles a week. All those who do not use kerosene have electricity in their homes, suggesting a very strong electricity preference when available (at least for lighting the home).

In Chamba, only 2 households (6 per cent of the respondent households) use about a bottle of kerosene per week, 46 per cent (16 of the 35 respondent households) use about two bottles a week, 26 per cent (9 households) use about three bottles a week. The rest use at least four bottles of kerosene per week, with one using as much as six bottles of kerosene weekly.

6.9 Summary

This chapter discussed the energy use patterns in Nsuta and Chamba. It has shown that rural people rationally opt for the most efficient and cost-effective fuel type for household cooking and lighting. Households in Nsuta used electricity to light their homes, but not for cooking. The principal reason was cost. Due to high energy bills, even households that have electricity opt to use firewood and charcoal in cooking. For households without electricity in Nsuta, firewood and charcoal are the preferred fuels for cooking and kerosene is the preferred fuel for lighting the home. In Chamba, because the option of electricity is not available to them, all the households use kerosene for lighting the home and firewood and charcoal for cooking.

The issue of using alternative energy sources was also investigated. Whereas an overwhelming 94 per cent of the households in Nsuta were willing to try alternative energy sources like liquefied petroleum gas, on the condition that it was cheap and available, the answers given in Chamba were more mixed. Here, the majority of them were not sure of what they would do if alternative sources were available, and as high as 41 per cent were not willing to try it at all.

With the gradual shift of households from the collection of woodfuels to buying, some households in the two villages now sell firewood and charcoal. The principal reason given for starting the sale was to earn some money to supplement their income from other sources. The sale of firewood appears to have been going on longer in Chamba than in Nsuta. Whereas sale of firewood in Chamba has been going on for about 20 years now, it is a relatively recent phenomenon in Nsuta, dating back only 10 years or so.

Chapter Seven

Local Perception of Deforestation and Conservation Measures

7.1 Introduction

As mentioned in the objectives of this thesis (1.10), an important part of this study involves an assessment of the perception of the local people on forest depletion and the efforts aimed at halting the process of deforestation. This chapter introduces the issue of how the people in Sekyere West and Nanumba Districts view deforestation and the links between woodfuel use and forest depletion.

This is particularly important because the way a people think about any particular resource influences to a very large extent how that particular resource is utilised. It is particularly important to incorporate local knowledge into this study because there is the tendency on the part of researchers to completely ignore local knowledge in studying issues that affect the lives of rural people. And as mentioned by Leach et al (1988), there exists a rich base of local knowledge, known variously as community environmental knowledge or indigenous technical knowledge, which rural people apply in managing their environment.

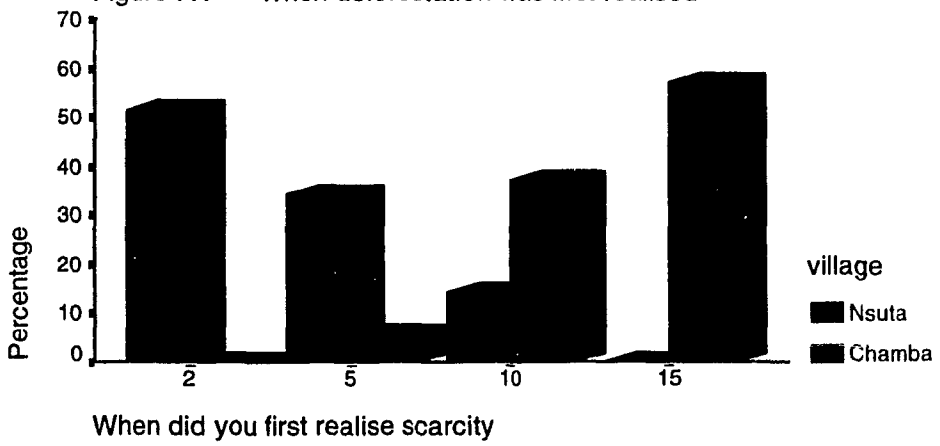
7.2 Local Perceptions on Deforestation.

As part of the household survey, respondents in the two settlements were asked a series of questions aimed at exploring their perception of deforestation in their areas. The author was not only interested in deforestation at the practical level, but also how the people perceived it. For example, the author was interested in rural people's perception of how long deforestation had been going on The principal issue of concern here was their

perception of the causes, extent and effects on their general day to day lives. Almost all the respondents reported realising deforestation in their environment.

Figure 7.1 illustrates the perception of the people of the two study areas on the reality of deforestation. As can be seen, people in the north (Chamba) perceived deforestation much earlier than those in the south (Nsuta). In Nsuta, more than half of the respondents (51 per cent) reported realising deforestation just a couple of years ago. A further 34 per cent of the respondents reported realising deforestation about five years ago. Only about 14 per cent of the respondents in Nsuta reported realising deforestation in their surroundings about 10 years ago.

Figure 7.1 When deforestation was first realised



Source: Fieldwork, 1995.

In contrast, about 57 per cent of the respondents in Chamba reported realising that there was deforestation in their surroundings more than 15 years ago. A further 37 per cent

of the respondents here reported realising deforestation about 10 years ago. Only about 6 per cent of the total respondents reported realising deforestation five years ago.

The yardstick used by the people in measuring deforestation was mainly the availability of trees, especially certain preferred species, the availability of arable land, scarcity of water and, interestingly, soil fertility. Interestingly, because the author assumed that rural farmers did not know the connection between deforestation and soil fertility. It turns out that the rural farmers had indeed very well developed and sophisticated techniques (maybe not "scientific") for determining soil fertility and land productivity. These techniques have been the product of decades of trial and error and form part of what has come to be known as indigenous knowledge systems (Dei, 1993). For example, on a visit to the farm of one of the respondents, the farmer informed the author about certain weeds that they looked for when assessing the fertility of a particular soil.

Table 7.1 is a summary of responses with regard to respondents' perception of deforestation or less trees and vegetative cover in their areas. The main basis for their conclusion of deforestation was by comparing the current status of the forests and vegetation cover with their memory of what existed in the past. One problem that the author envisaged was the problem of selective recall and romanticising the past as better than today.

It is clear from the table (7.1) that the overwhelming majority of the respondents in the two settlements do believe that there has been some amount of deforestation, especially in the last ten years. There was very little difference in the responses of the two villages. Only one respondent in Chamba said there was actually an improvement in the vegetation status

of the area. But in Nsuta, of the 35 respondents, all were sure there was some amount of deforestation, except one, who reported having no idea.

Table 7.1 Local perception of deforestation

Settlement	Nsuta		Chamba	
	Now and 10 years ago, more or less tree and vegetative cover		Now and 10 years ago, more or less tree and vegetative cover	
	No.	%	No.	%
More	-	-	1	2.9
Less	34	97.1	34	97.1
No idea	1	2.9	-	-
Total	35	100.0	35	100.0

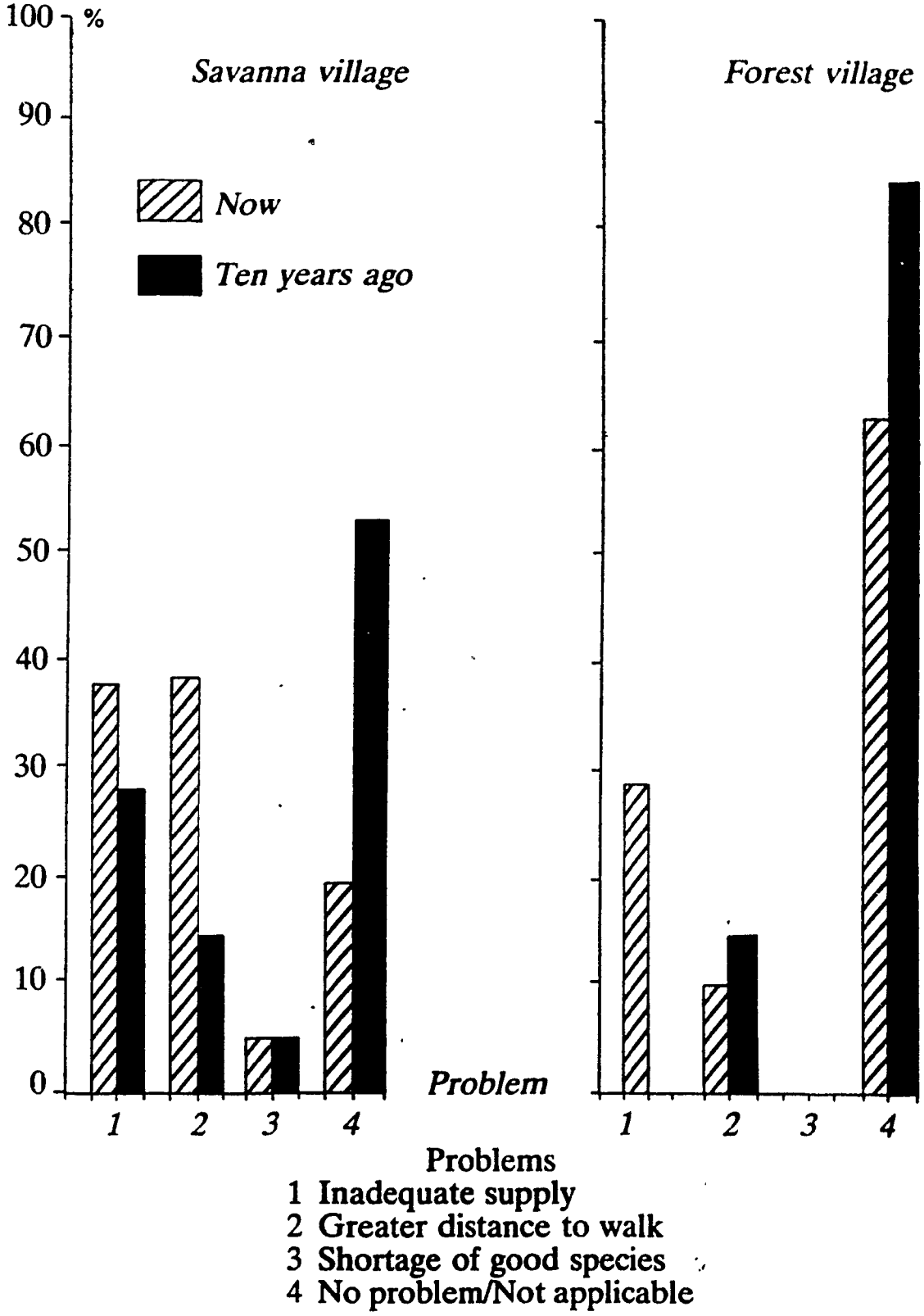
Source: Fieldwork, 1995

One important observation to be made here is that although the respondents in the two areas perceive the tree stock as dwindling, they do not see a future of complete loss of all tree cover. To them therefore, the term "deforestation" is perceived not so much as complete and permanent clearance of trees as in the gradual reduction in the quantity and quality of tree and vegetative cover. Most respondents also mentioned that the disappearance of trees begins first on a selective basis, with certain preferred species disappearing first. Ironically, the most preferred tree for both firewood and charcoal in Chamba was the shea nut tree (*Butyrospermum parkii*). This tree was also one of the two most economically valuable trees (the other one is the dawadawa tree) in the area. There is a therefore a ban on the

cutting of live ones. As one gets near the village, and indeed most of the villages in the Northern and Upper West Regions, one cannot fail to notice that most of the standing trees are of these two species. The author surmises, however, that conserving these trees has more to do with the people's need for these trees' valuable resources rather than the ban imposed by the government. Interviews with charcoal producers in Jediako revealed that the most preferred species for charcoal production there were **baku** (*Tieghemela heckelii*), **odum** *(Maclura excelsa)*, **edinam** (*Entandrophragma angolense*) and **mahogany** (*Kyaya spp*). Most of these, are also very valuable export lumber trees. In recent years, however, there has been a ban on their exploitation, both for export and for woodfuel.

These findings compare with those of Ardayfio-Schandorf (1993), who found that there were problems of woodfuel collection in both the savanna and the forest regions of Ghana (figure 7.2). She reported that the main complaints of rural people with regard to the collection of woodfuel (which is a good indication of the level of deforestation) were that inadequate supply of wood, greater distance to walk and shortage of good species. But in general, she found that these problems were more pronounced in the savanna than in the forest, which is consistent with the findings of this thesis. She also found that more people reported these problems today than ten years ago, which is also consistent with the findings of this thesis.

Figure 7.2 Problems of woodfuel collection in different ecosystems



7.3 Local perception of the causes of deforestation

Having assessed local perception on the status of forests in the area, the next step involved assessing local perception of the causes. In presenting the answers of the respondents, the author will attempt to relate these to his personal observations of the physical evidence in the field. Table 7.2 is a summary of the answers given by the respondents in the two settlements to the question of the causes of deforestation in their area.

Table 7.2 Local perception of the causes of deforestation

Settlement	Nsuta		Chamba	
Causes	**No.**	**%**	**No.**	**%**
Woodfuel harvesting	25	40.3	26	52.0
Bushfires	31	50.0	16	32.0
It is natural	6	9.7	-	-
Other human activities	-	-	8	15.6
Total	**62**	**100.0**	**50**	**100.0**

Multiple responses were recorded; Source: Fieldwork, 1995

In posing the question, room was made for the respondents to give more than one response if they so wished. The result is that most of the respondents gave multiple responses, making the total number of recorded responses 62 in Nsuta and 50 in Chamba.

From the table it is evident that the principal factors blamed for deforestation in the two areas were wood harvesting and bushfires. Whereas the people in Nsuta blamed bushfires as the primary cause of deforestation in their area (50 per cent), those in Chamba blamed

cutting down trees as the primary cause (52 per cent). Second in order of importance in Chamba are bushfires (32 per cent) and in Nsuta tree felling (40.3 per cent). The remaining 9.7 per cent of the recorded responses in Nsuta blamed natural causes. In Chamba, the remaining 15.6 per cent blamed deforestation on other human activities, such as clearing large tracts of land for mechanised farming.

With regard to bushfires, there was this seemingly contradictory position on the parts of respondents in the two areas. Respondents on the one hand, blamed bushfires as part of the causes of deforestation in their area. On the other hand, they regarded setting fire to dry grasses as part of their farming practices. This is clearly illustrated by Afa Mahmaru when he said:

> You know the grasses here have to be burnt early in the dry season, so that the new ones can grow quickly for our cattle to feed on. When we leave the dry grasses for too long, it would be burnt by someone when we least expect it. In that case, our animals would have a very difficult dry season. So even though we know that burning the grass has its own problems, we feel we have to do it in order to save our animals (Personal interview).

None of the respondents in either of the settlements blamed the deteriorating conditions of their forests on poor agricultural practices, logging or overgrazing. In Sekyere West, although logging played a very important role in the deforestation process by way of opening up the forests, it is, however, not of much importance in recent years. This is because the main contribution of the logging industry is not in the cutting down of trees itself, but in the creation of access roads into these otherwise inaccessible forests. Different issues have to be taken into consideration in the case of Nanumba District. Here, grazing was one of the significant causes of soil erosion and land degradation that the author observed, even though

it was not mentioned by any of the respondents in Chamba. The author observed that animal rearing, especially cattle, sheep and goats was an important source of not only income, but status. The main problem observed was that the animals were left to graze free range. The author noticed a herd of cattle grazing on land that was clearly overgrazed in more than one instance, during the time the research team were in Chamba.

7.4 Local Effects of Deforestation

Table 7.3 Local perception of the effects of deforestation.

Settlement	Nsuta		Chamba	
Effects of Deforestation	**No.**	**%**	**No.**	**%**
Less rainfall	31	23.8	9	10.0
Rivers dry up	33	25.4	19	11.1
Woodfuel scarcity	11	8.5	29	32.2
Poor agricultural yield	27	20.8	26	28.9
Weed and grass invasion	28	21.5	12	13.3
Don't know	-	-	4	4.4
Total	**130**	**100.0**	**90**	**100**

Multiple responses were recorded; Source: Fieldwork, 1995

In determining the people's understanding of the effects of deforestation on their environment, the question was asked, *What, in your opinion, are the effects of deforestation in your area?* Several answers were given, which have been summarised in table 7.3. Here

too, multiple answers were given by most respondents. These responses will be discussed individually in separate sections

7.4.1 Declining Soil Fertility and Agricultural Yields

Soil fertility is dependent on, among other things, the protection of vegetal cover and the return of nutrients to the soil through the decomposition of vegetation. When trees are removed and soils are exposed, they are subject to the full impact of the elements, including rain and wind. This results in erosion, both sheet and gully erosion. This not only results in the removal of nutrient-rich top soil, but also results in the leaching of these nutrients in porous soils. This renders the soils nutrient-deficient and without a binding structure. As mentioned by Benneh and Agyepong (1990), declining soil fertility, resulting from erosion, is one of the major problems facing Ghana.

Declining agricultural yields formed about 20.8 per cent of the recorded responses in Nsuta (table 7.3). They blamed declining soil fertility as the immediate causes for this. Further investigation revealed that the problem was more widely reported in Chamba than in Nsuta. Respondents complained that they had to significantly increase the size of their farming land to harvest the same quantity of foodstuffs they harvested a few years ago. One of the respondents complained that in addition to increasing his plots to harvest the same quantity, the size of the tubers of yams that he harvests has been decreasing steadily over the years. Unfortunately, in order to increase yields, more land is cleared of trees, thus exacerbating the problem of deforestation.

Government agricultural extension workers were contacted for their comments and they maintained that the problem of declining yields was not caused solely by soil erosion, but by years of overcropping, which has reduced the productivity of the land. They maintained that fallow periods have been cut short, without any compensation being made by way of supplementing the fertility of the soil with fertilizers. They also mentioned the invasion of pests and diseases as a cause of declining farm yields.

7.4.2 Weeds and Grass Invasion

Respondents also indicated that the invasion of grasses and weeds as one of the effects of deforestation. In Nsuta, 21.5 per cent of the recorded responses cited this as one of the effects, compared to 13. 3 per cent in Chamba. The reason for this may be due to the fact that Chamba is located in the grassland region (savanna) so grasses are not an uncommon thing. However, Nsuta, which is in the heart of the forest region, has not known the proliferation of grasses and weeds until recent years. The conversion of parts of forest lands to grassland is seen, by some of them, as a sign of the deterioration of the environment.

Farmers in the two areas pointed to a particular weed as a precursor of poor yields. They mentioned that when one starts seeing **Acheampong** weed *(Chromolaena odorata)* on one's plot of land, then it means the time has come to abandon the land. Especially in Nsuta, farmers mentioned that until recently, that particular weed was not known in the area, and blamed the proliferation of this and other weeds on the deterioration of the quality of their land.

7.4.3 Climatic Variation

One other issue that was explored was the increase in the unreliability of rainfall patterns in recent years. Respondents in the two settlements reported that there has been decreasing rainfall over the years. About 23 per cent of the recorded responses in Nsuta and 10 per cent in Chamba reported this. The immediate reasons they gave for the decrease in rainfall were many and varied, including bushfires and having fewer trees today.

Of more concern to them was not the decrease in the amount of rainfall, but the pattern. For example, farmers in Nsuta claimed that the first rains used to come in January, but in recent years, the pattern has been distorted such that the first rains don't come until March. In the same vein, the farmers in Chamba claimed the dry period of the year used to last less than five months, but in recent years, the dry period can last as long as 6 months, or in some years, seven, making the growing season unusually short.

Clearing of trees around the settlement has also exposed the villages to the full impacts of the elements. Residents complained about too much sunshine and windstorms, especially in Chamba. Respondents in Chamba especially felt windstorms here a big bother since they had thatched roofs, which were easily blown away during these storms. Windstorms also pose problems by way of destroying food crops in their farms. Their homes were also under severe threats during the dry season when the wind easily blows sparks of fire into their thatch houses, causing many fires.

There was no way all these claims could be verified since no time series data was available to make it possible to compare recent patterns with the past. It is also not possible to claim that these changes are localised since they are occurring all over the country.

Generally, the rainfall pattern in the country is known to have undergone some changes in recent years, which makes it difficult to claim that the unreliability of rainfall is peculiar to these villages. One cannot therefore readily claim that the depletion of trees in the study area is the cause of these changes.

7.4.4 The Social Effects

The social effect of deforestation is related to the distances covered in searching for firewood. Firewood collection has become a time-consuming activity and as seen on table 7.3, 32.2 per cent of the respondents in Chamba and 8.5 per cent in Nsuta mentioned woodfuel scarcity as one of the effects of deforestation. The time used in searching for firewood can affect the ability of the farmers in maintaining their farms.

The difficulty in getting firewood can also in a way affect the education of the children since in some households, especially in Nsuta, the children in the household are responsible for the collection of firewood. During the time when there is the need for more firewood, especially during festive occasions like Christmas, Easter and during funerals in the south and Ramadan and out-dooring ceremonies in the north, children in the household have to sacrifice their schooling for the collection of firewood.

7.5 Efforts at Conservation

Trees are a renewable resource, and with the appropriate management and conservation measures, can be a sustainable resource in the long run. The immediate and logical response to the depletion of trees in most developing countries is to better manage

forest resources and to plant more trees. At the local level too, attempts have been made, both individually and communally to devise remedies. How successful these remedies have been is a whole different question.

7.5.1 Private Efforts.

Economic motivation is one of the most powerful incentives for tree planting by private individuals or organizations. It has been noted that in the rural areas, wood is collected at no economic cost. The economic motivation for planting trees has therefore not been very strong in the villages. In recent years, however, some farmers have shown great interest in it, and have actually taken up the idea of farm forestry. These are programmes aimed at encouraging commercial tree growing by individual farmers on their own private lands (Leach et al, 1988). In our study areas, however, with the exception of fruit trees, there are virtually no private efforts at planting trees, for firewood, for example.

In Chamba, several small mango plantations were identified. These were planted by individuals mainly because of their fruit, which is harvested annually for sale. Other tree crops planted include orange, coconut and guava trees. The main trees planted in Nsuta, apart from commercial cocoa and oil palm plantations are coconut and orange trees. One of the main reasons why tree planting was not very popular in the study areas was because there was no direct economic benefit to the planter. Also there was scarcity of land, especially in Nsuta, where populations were high and land availability was a problem.

In Nanumba District, there has been a strong traditional conservation culture, which is now being undermined by the process of modernization and the transfer of power from

traditional authorities to civil servants and government appointees. For example, among the Nanumba people, there are chiefs traditionally "enskinned" (the process of making one a chief in the north, "enstooled" in the south) to take care of certain species of trees which the paramount chief deems important because of their food or medicinal value to the people. The chief was responsible for, among other things, ensuring the live trees were not cut down or misused. There was an elaborate procedure for reprimanding and punishing offenders. All these are gradually fading away and are now being replaced by national criminal and penal codes, which do not regard felling of trees on private or communal land as offenses (Conversations with Kumahenaa and Dohinaa, subchiefs to the Paramount Chief of the Nanumba Traditional Area in Bimbilla).

7.5.2 Public Efforts

Various afforestation programmes have been started by government and local councils, in an attempt to reverse the trend of tree depletion in Ghana. In recent years, the term social or community forestry has come to be very important in the attempt to get communities involved in the planting of trees. The participation of the community is considered necessary in raising, tending and protecting the planted seedlings. Agro-forestry has also been promoted by the government and local farmers are encouraged to plant trees along with their food crops.

The efforts of the government in this direction have largely been a failure due to several factors, including a lack of a consistent programme on the part of the government and also a lukewarm attitude on the part of local residents. Instead of developing seedlings which

the people would actually find useful, the tree seedlings promoted by the government are mainly teak and neem, which the local people find to be of no benefit to them.

7.6 Summary

The study has shown that there is a lack of documented secondary data at the local level. Even though the fact that there is deforestation in the study villages has been acknowledged by respondents in the area, there are no secondary data and information to support it. There exists, however, a great wealth of local information on which to base some conclusions.

It has been pointed out that local perceptions of the causes of deforestation are mainly felling of trees, bushfires and other human activities. On the effects of deforestation, they point to declining agricultural yields, woodfuel scarcity and the invasion of weeds and grasses as the main effects of deforestation. Whereas the people in Nsuta thought bushfires were the main cause of deforestation, those in Chamba blamed wood harvesting as the principal cause. These have some impact on the lives of the people. Residents have to travel longer distances to get firewood. Farmers have to increase the size of their farms in order to get the same yield as they did a few years ago. Although it was not possible to get physical evidence to support all the claims of the local people, it does not in any way indicate a lack of environmental knowledge on their part.

The chapter has shown that rural people are well aware of the depletion of trees in their vicinity. This kind of knowledge is very valuable and may play a very important role in rural people's acceptance of and participation in efforts to combat the problem. In the

meantime though, despite the knowledge that deforestation is a problem, it seems that efforts at reafforestation have not achieved the desired impacts. There is apathy among many of the residents in the study villages, mainly because they see a lot of inconsistency on the part of the central government.

Finally, a traditional conservation ethic in the study villages is gradually being eroded with the transfer of administrative power from traditional authorities to the central and local government officials. The effect of these combined is the failure of reafforestation programmes leaving the sustainable use of forests dependent on natural regeneration.

Chapter Eight

Summary, Recommendations and Conclusion

8.1 Introduction

This thesis set out to examine those factors associated with woodfuel use and deforestation in rural Ghana. In order to achieve this, four main objectives were identified. These included examining the factors that influence the demand for, and use of woodfuels, the role of traditional authorities and traditional gatherers in the process, the perception of rural people on forest depletion and the causal relationship between woodfuel use and wood scarcity and finally, evaluating the field statistics and making recommendations to minimize effects on the environment.

The role of woodfuel demand in deforestation has been documented in the studies presented in the literature review in chapter one. In addition to these, two models on spatial patterns resulting from woodfuel use were also presented (figures 1.1 and 1.2). In this chapter, the author summarizes the main findings of the thesis. At the end of the chapter, some recommendations are made by the author. This is in line with the fourth objective of the thesis, which is to evaluate the field statistics and come out with recommendations to minimize the effects of deforestation and woodfuel use on the environment.

8.2 Woodfuel Production in Rural Ghana

This thesis has shown that Ghana is a primarily rural country with more than 70 per cent of its people living in rural communities. The vast majority of rural households use woodfuels to satisfy their energy requirements, especially for cooking and heating. It was

noted in chapter four that the main fuels used in Ghanaian households were woodfuels (comprising charcoal and firewood), electricity, kerosene, liquefied petroleum gas and stubbles.

With regard to electricity, the thesis has shown that very few urban households (just 2.6 per cent) use electricity for cooking. The situation is even more extreme when rural Ghana is considered. Only 0.1 per cent of rural households use electricity to satisfy their energy requirements. When liquefied petroleum gas is considered, it is evident that it is not a favoured source of energy for Ghanaian households. Only 4.6 urban households and 0.1 per cent of rural households use liquefied petroleum gas to satisfy their energy requirements. For both rural and urban Ghana, woodfuels are the main source of energy for household uses. Whereas charcoal represents about 10.5 per cent of rural energy use, it represents almost 70 per cent of urban household energy.

This thesis has also shown that rural households have three main options when it comes to securing their firewood needs. The first option is to collect firewood from the bush - either from the family farms and fallow lands or from communal lands, commonly referred to as "common property." Research in the field has revealed that most rural households secure their firewood requirements this way. The second option available to rural households is purchasing. About 11.4 per cent of households in Nsuta and none of the households in Chamba relied exclusively on this option to satisfy their energy requirements. The third and final option is to collect some and purchase some. This is a sort of transition period for most families who want to collect all they need but cannot do so due to one problem or another.

Ideally, most rural households will like to collect all the firewood they use. But as the collection of firewood increasingly comes under pressure from various sources, there is a gradual shift from collection to purchasing. It is apparent from this thesis that it is becoming increasingly difficult to secure firewood from the bush due to the constraints. These constraints, which are increasingly becoming apparent, include time and distance constraints. This thesis has revealed that rural households now have to travel increasing distances into the bush to get their firewood requirements. Time used to collect firewood is increasing with the years. That apart, households now have to spend more hours in getting enough firewood to carry home. This is mainly due to two reasons. The first, because they have to cover longer distances and the second because of thinning vegetation, some species which are preferred are now more difficult to get, thus resulting in more and more searches to get the preferred species.

Generally, it has been shown that households in the savannah spend more time in collecting firewood than their counterparts in the forest region. For instance, whereas Nsuta households spent about two hours in collecting a head load of firewood, it took a household in Chamba at least twice as much time. This affects not only the adults in the household, but the children, especially those of school going age, who have to sometimes sacrifice school to look for firewood.

On the issue of who does the collection of firewood in the household, some revelation, contrary to earlier held views was made. Before the field work, it was assumed that women did all the collection of firewood in the household. This thesis has shown that, contrary to the conclusions of earlier researchers that only women took part in the search for, and

transportation of firewood in the household, men and children of both sexes did, in fact, take part in the collection and transportation of firewood.

Due to the constraints of acquiring firewood from the bush, households are gradually resorting to purchasing their firewood requirements from their neighbours, who are also supplementing their income from their regular jobs by taking firewood sales as a second job. Firewood in the rural areas is mainly sold to middlemen. The firewood is transported to urban centres to meet the high firewood demand in the cities and other bigger towns. But increasingly, the buyers of the firewood tend to include rural dwellers too, who are buying the firewood to supplement what they collect themselves.

Most households in rural Ghana tend to use charcoal only incidentally for cooking,especially when they have leftovers from using firewood. However, about 20 per cent of households in Nsuta and about 5.7 per cent of those in Chamba indicated that they always used charcoal. This does not mean the exclusive use of charcoal, but that they always used charcoal as part of their cooking fuels. There are some households which buy their charcoal needs from the market. The high cost of charcoal does not make it an attractive fuel for large households, or for exclusive use. Hence the exclusive use of charcoal for cooking is found only in small households.

8.3 Woodfuel Consumption

As mentioned earlier (8.2), woodfuels are the commonest fuels used in both rural and urban Ghanaian households. In chapter six of this thesis, the main uses to which firewood is put in the household were identified. These include cooking, heating, lighting and sale. The

principal reasons why firewood is preferred for cooking in rural households include the ready availability of the fuel as a free good. There are some households, however, which reported that they used it because it was cheap, compared to the other options like LPG, electricity or even charcoal. It is of significance to note that in Chamba, the main reason given for using firewood was because it was the only real option available to them.

Due, mainly, to the market demand for firewood in urban areas, and increasingly in rural Ghana, and also the need to make some money to supplement family income, the sale of firewood is increasingly becoming an important part of the income generation activities of rural households. For instance, about 22 per cent of households in Nsuta and 34 per cent in Chamba now sell firewood. However, this seems to be a more recent phenomenon in Nsuta than in Chamba. In Chamba, most firewood selling households have been in the business for a period ranging between five and 20 years. In Nsuta, the range is between two and eight years.

Charcoal is used primarily as a secondary fuel in most rural households. This was mainly because of the high cost of charcoal and, for those who can make their own charcoal, the tediousness of the process. Charcoal is mainly used by craftsmen, who usually require very small quantities of charcoal at a time, for example, gold and blacksmiths. Charcoal is also sold by some rural households, not only to middlemen from urban areas, but to their neighbours who can afford to pay for charcoal.

In choosing an energy type to use, a household must take several factors into consideration. These include the availability of that fuel, its affordability and convenience. Most rural households use woodfuels not only because they are affordable or cheap, but

because it is the only real option open to them. Especially in northern Ghana, where electricity is almost nonexistent, rural households have no choice but to use woodfuels. For rural households in the south who enjoy electricity, the reason why woodfuels are still used, especially in cooking, is because of the high cost of electricity and the cooking equipment needed to use electricity. The thesis has shown that most rural households which have some access to electricity and LPG, especially in the south of Ghana, are willing to make the switch from biomass to other alternatives like LPG or electricity. The problem comes down to how affordable the switch will be.

Even though most households in non-electricity areas use firewood to satisfy their cooking needs, they still overwhelmingly use kerosene to light up their homes. This is mainly because of the efficiency of kerosene when compared to firewood or charcoal. One can carry a lantern about in the dark, but cannot say the same of fire from charcoal or firewood. Apart from that, firewood, is bulky and produces smoke, which is not convenient for sleeping.

8.4 Woodfuels and Deforestation - the Links

As presented in the literature review in chapter one, there is ample evidence that points to the deleterious impacts of woodfuel consumption on forests and woodlands. The impact of wood extraction and charcoal production on the forests in the study areas could be better assessed by relating firewood extracted figures and charcoal production figures with the rate of natural regeneration of vegetation. Such an assessment is, however, hampered by the lack of data not only on the natural regeneration rate of forests in Ghana, but by the lack of reliable figures on how much firewood is harvested annually and how much charcoal is

produced annually. This does not mean, however, that a qualitative assessment of the situation cannot be made, given the type of analysis as has been done in this thesis.

This thesis has revealed that the annual consumption of woodfuels is on the increase and is expected to even increase at a faster rate with increasing populations. Taking the statistics presented in this thesis into consideration, a trend of high forest exploitation emerges. There is therefore no wonder that 82 per cent of all wood cut in Ghana is used as firewood or charcoal. In view of the fact that woodfuel use must continue given that there is no real alternative in rural Ghana, with the high population growth, the author projects increasing annual consumption.

The links between woodfuel use and deforestation are further apparent when one takes into consideration the work of Tuffuoh (1989), mentioned in chapter one (1.8). His figures on estimated woodstands and woodfuel consumption in Ghana clearly illustrate the links between the use of woodfuels and deforestation or the loss of vegetation. A serious aspect of the effect of woodfuel extraction on forests is that the demand for, and consumption of woodfuels show no signs of decreasing, in the face of dwindling stock. On the contrary, demand for woodfuels will continue to increase as populations increase and other alternative energy sources are not exploited. There is woefully inadequate data at the household level on the impact of tree depletion on the household economy and how this translates into monetary terms and social terms.

8.5 Spatial Patterns of Deforestation

In chapter one, the author presented two models dealing with the spatial patterns emerging from woodfuel production and consumption. As noted, Digernes' model of fuel-supply for domestic use in dry land population centres depicted shifts in energy use in Bara. The destruction of the vegetation in the immediate vicinity of the town made it impossible for the women to collect the fuel they needed from the fields. This led to dependence on charcoal suppliers from surrounding villages, where production resulted in deforestation.

Observation in the field in the two study sites in Ghana has shown that the use of woodfuels in the study villages has not resulted in the changes that Digernes observed in his model (figure 1.1). Firewood has been, and continues to be the major source of fuel in the villages. The collection of firewood continues to be basically subsistent, and even though households have to walk longer distances, charcoal has not replaced firewood as the major fuel. As regards the flow of woodfuel, it can be said that although the collection of firewood for urban markets has not developed, some quantity of firewood from the study villages gets to the urban centres through sales to individual traders and middlemen. The production of charcoal, on the other hand, is gaining increasing importance as a source of supply of energy in larger urban centres. It is, however, possible that the situation in the study areas have not deteriorated to the point where changes observed by Digernes can be noticed.

Whitney's model (figure 1.2) on the other hand, essentially looked at changes in the vegetation around the settlement as the demand for fuel increased and appears to better fit observations in Nsuta and Chamba. In short, the model stated that as the demand for fuelwood increased, so did the intensity of fuel gathering activities. The gathering of firewood

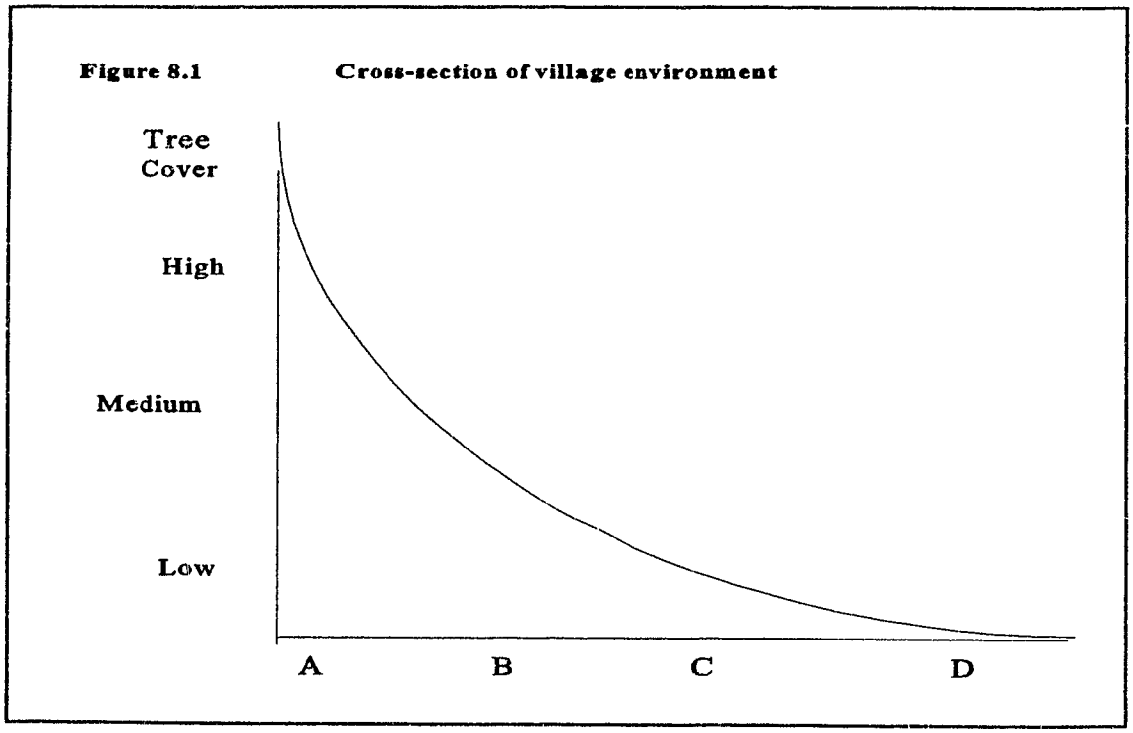
results in the depletion of vegetation. Vegetation destruction begins in the immediate surroundings of the population centre, and then gradually moves to other parts of the woodland as wood gathering activities are extended to other parts. Thus, as demand for fuelwood increases, the zone of intense fuel-gathering moves away from the centre, leaving in its trail an area where most of the wood that can be harvested for fuel has been destroyed.

Studies in the field have shown that households now prefer to go further distances for wood as it takes a shorter time gathering a head load further away from the village as compared to the immediate vicinity of the village. This indicates that as one moves from the village, the intensity of vegetation cover increases. Observations made in the two study villages tend to support this. This is confirmed by the diagram of the spatial pattern of tree cover intensity shown in chapter seven In order of sparseness in vegetation cover, the village itself came first, followed by communal lands, then farms and fallow lands and finally forests. This spatial pattern evolved in the villages may be likened to stage three in Whitney's model. Her energy flows, however, do not fully describe the situation as observed in the study villages. This is mainly because charcoal has not replaced firewood as the principal fuel. Moreover, the charcoal consumed in the villages was not purchased from other sources. However, a limited supply of other fuel types (in the case of the study villages electricity and kerosene) has been coming in from other sources.

This thesis has so far shown that at least in rural Ghana, there is no crisis in terms of the availability of wood resources for energy. This does not mean, however, that the long-term outlook is very bright. Currently, there seems to be a gradual thinning of the forest resources in and around rural settlements. This is mainly because of the ease with which forest

resources nearest the village may be exploited. With the depletion of the forest resources in and around the village, residents go further distances to look for wood. Thus, as one moves nearer the village, one can clearly see a pattern of deforestation emerging. Thus a simple cross section of lands around the village will look similar to figure 8.1. This figure is not drawn to scale and is not intended to show any measurements, but a general impression of the nature and thickness of vegetation as one moves away from the settlement.

Figure 8.1 **Cross-section of village environment**



A=Forests B=Farms and Fallowlands C=Communal lands D=Village

Source: Fieldwork, 1995.

This cross-section shows a deterioration in the quality of the environment as one draws nearer to the village. This is because of the over-exploitation of the forest resources in around the village. The typical village environment can be likened to stages two and three

on Whitney's model where wood resources in the immediate vicinity of the settlement is depleted and residents have to go further away from the settlement to get their fuel needs. As this progresses, less firewood and more charcoal is used, since it is easier to transport.

8.6 The Two Study Sites

Evidence from Chamba and Nsuta confirm that deforestation and environmental degradation are taking place in both the savanna belt and the forest region. Before going to the field, the author assumed that the difficulties in getting woodfuel was a feature of the savanna and not the forest region. Evidence from the field suggests that both sites have some difficulty with woodfuel gathering. However, the problem of distance is more pronounced in the north than in the south. One reason is that with density of vegetation cover in the south, it takes less time to get enough wood to carry home.

Most of the firewood in Nsuta is collected by the children, with the husband and wife all taking part in the process. In Chamba, however, primary responsibility still lie on the woman. There was also some differences in the purchase of firewood. More people now resort to buying firewood in Nsuta than in Chamba. There was no significant difference in the use of firewood, except that all the respondents with tertiary education in Nsuta and all those with secondary and tertiary education in Chamba had switched from using firewood to charcoal, suggesting that as one's level of education increases (which translates into income level and status in society), there is the tendency to use less firewood and more charcoal. Family size is also linked to education as those with higher education tend to have smaller families. Therefore, those with less education tend to have higher family sizes, not only

because they tend to need more labour, but also because they tend to be involved more in the extended family system, sometimes taking in other members of the family to live with them.

Both sites, have seen a gradual deterioration in the quality of their vegetation over the years. But with the introduction of electricity in Nsuta, there has been a reduction in the dependence on kerosene and woodfuel to light homes. The shift, however, from using woodfuels to electric stoves has not occurred largely because of the costs associated with electricity use. With the general level of modernization in Nsuta, it is only a matter of time before the shift begins.

8.6 Perception and Conservation Measures

One issue that has come up frequently in the development of solutions to environmental problems in developing countries in general, has been the perceptions of local people. The attitude of experts and researchers toward the perceptions of the people has often been that:

> . . . the majority of farmers and pastoralists are unaware of the complex environmental processes that degrade the environment, or if they are aware, they are insensitive to their own and other future interests. Because of their lack of understanding and appreciation for the environment, they are incapable of finding solutions to environmental problems without external assistance (Baker, 1974:252).

There was no evidence in the field to support the above assertion. Contrary to that, as presented in chapter eight, rural people have a keen sense of environmental awareness. They were, as a matter of fact, aware of the increasing loss of trees in their surroundings. They were also aware of the causes of the problem. For example, local people were aware that

bushfires, woodfuel extraction, and inappropriate farming practices were among the causes of tree depletion in their areas. Apart from that, they are also aware of the impact of the problem on their livelihoods. Local people were able to mention rivers drying up, wood scarcity, weed and grass invasion and poor agricultural yields as some of the effects of tree depletion. They have, however, not been able to find lasting solutions to the problem, not because they are ignorant and indifferent, but because they have been constrained by circumstances beyond their control. The knowledge of local people is very valuable in designing future solutions. Current failures of the tree planting programmes can be blamed largely to the inconsistency on the part of the central government which confuses local people with one programme after another.

The traditional conservation base of rural areas is gradually being eroded. One of the most effective means of eroding traditional values with regard to conservation is the transfer of administrative and judicial powers from traditional authorities to the central and local governments. Traditional authorities, typified by chiefs, can no longer, in most cases, enforce traditional laws on forest conservation, without breaking the law themselves. For example, traditionally, the *Dohinaa*, a sub-chief of the Nanumba people in charge of certain species of trees had the right to seize any products from these trees believed to have been acquired illegally. But with current changes, this can be against the criminal code of the country and the chief could face criminal prosecution. This has led to some people engaging in acts that destroy the environment with impunity because the justice system is so slow and corrupt, by the time they are brought to justice, if ever, the harm has already been done.

8.7 Recommendations

In line with the fourth objective of this thesis, which is to evaluate the field statistics and come out with a set of recommendations to minimize the effects of woodfuel use on the environment, in this section, the author makes a set of recommendations to help reduce the rate of deforestation in rural Ghana and also to ensure that there is a continuous supply of woodfuel for the population. This is because even as efforts are made to develop alternative energy sources, efforts must also be made to guarantee continued supply of the current fuel source - woodfuels. This is because until there is a complete switch from using woodfuels to other alternatives, the only real option available to most rural households is woodfuel. It would therefore be a real disaster to witness massive shortages of woodfuels in rural areas. And judging from the literature, with current trends, the possibility of a real "energy crisis" is not too far in the future. It is with this in mind that the following specific recommendations are made.

8.7.1 Village Woodlots

As noted in the previous chapter, the scarcity of land has been one of the major reasons why people have not embraced the idea of tree planting on a large scale. One way to overcome this obstacle is to use communal lands, in addition to encouraging people to use private lands for the purpose of tree planting. Communal lands could be used to establish woodlots. To further increase the enthusiasm and participation of the local people, these woodlots could be placed under their care, ownership and management, but with technical support from experts from the ministry of agriculture's extension department. Emphasis

should be placed on the planting of economically beneficial trees, like the shea nut tree in the north, which is regarded as the most important tree in the area. There will also be the need to reduce livestock herd sizes in northern Ghana and restrict them from grazing on fragile areas. This will also free some lands to go into woodlots. The announcement by the Chief Conservator of forests of the creation of a savanna woodlot management project (Ghana Forest and Wildlife Management) to start in 1997 (Tevie, 1996) in a step in the right direction. What is needed is the political will to see it through.

8.7.2 Introduction and Promotion of Improved Stoves

It is no secret that fuel use at current standards is not efficient. If Ghana, and indeed most Sub-Saharan African countries are to win the war against the over-exploitation of forest resources, then a serious attempt needs to be made to improve the energy efficiency of household cooking stoves. The commonest firewood stove in rural Ghana consists of the "three-stone" fireplace - three stones placed in a triangular position and firewood placed between the stones. The stones act as support for the pot of food to be cooked. The commonest equipment for the use of charcoal is the "coalpot," described in chapter six (6.5). This is far from ideal because it wastes a lot of energy. There have been attempts by the government in recent years to introduce more efficient stoves for household cooking. An example is the "Ahebenso" coalpot, which has been promoted these last few years by the Ministry of Energy. This is a step in the right direction. What needs to be done is an intensified attempt on the part of the ministry to train local craftsmen in the manufacture of these cheap and more efficient stoves for easy local assimilation.

In the past, local traditional values and cultural practices were not taken into account when these energy saving devises were designed. For example, the introduction of the solar powered cooking stove in the late eighties was a good idea, with the exception that one had to cook in the open sun in order to maximize the full potential of the stove. The question was how could one cook in the hot tropical sun of West Africa? Another example is the introduction of the highly energy-efficient stove for which women had to stand in order to use them. This device also did not take into account the fact most West African dishes were prepared sitting down. The design of the device was therefore culturally incompatible with the values of the people. In designing energy saving stoves, all attempts should be made to get local inputs on what rural people consider the most desirable features of a stove.

8.7.3 Improved Charcoal Production

There is no denying the fact that charcoal is an important fuel for urban households and for an increasing proportion of rural households too. There is also no denying that the current earth-mound method of charcoal production employed by most charcoal producers in Ghana is not efficient. Contrary to that, the earth mound method is very wasteful. According to the Mampong Forestry Office, for every bag of charcoal produced, at least another bag or more is wasted. These wastes could be reduced considerably by helping the producers to adopt the use of more efficient methods such as steel kilns. One very important reason why commercial charcoal producers have not adopted these methods is the cost involved. A government subsidy of these kilns, or at least the provision of government backed credit will go a long way in helping these producers to acquire the equipment needed.

8.7.4 Substitution of Commercial Energy

The demand for firewood and charcoal continues to contribute to the deforestation process. Demand for these fuels continues to increase, especially in the urban areas, and increasingly in the rural areas too. It is reasonable to suggest that a decrease in the consumption of these fuels, both in rural and urban areas, would drastically reduce the pressure currently put on Ghanaian forests. One way of reducing the use of woodfuels is for a concerted attempt to be made to encourage households, especially in urban areas where alternative energy sources are available, to switch to these alternatives. It has been the official position of the government in Ghana to encourage the use of alternative commercial fuels like electricity and LPG. Efforts in this direction have met very little success, even in the urban areas, for various reasons. The reasons include the prices of these fuels and also the cost of stoves needed for the use of these fuels.

One solution is for the government to subsidize these fuels and the stoves. This would make them cheaper and more affordable to the average household. In the case of LPG, there is the need for the government to put in place measures that would ensure a steady supply of gas to sustain the interest of the people in the use of this fuel. But in this era of World Bank and IMF sponsored Structural Adjustment Programmes, there is little chance of the government beginning any programmes that involve subsidies, particularly when subsidies on even more basic things like farm implements and fertilisers are being withdrawn in response to these powerful external pressures.

8.7.5 Rural Electrification

The current rural electrification programme is in the right direction and should be continued at a faster pace. After all, rural settlements make up about 70 per cent of the population. An improvement in the lives of the rural people will, in effect, mean an improvement in the lives of the majority of Ghanaians. The current system of over concentration of resources in the urban centres needs to be changed for more emphasis on rural areas. When rural households have access to electricity and other alternative energy sources, it does not, however, necessarily mean that they will use it. The example of Nsuta readily comes to mind. Even though the settlement has been enjoying electricity for sometime now, most households still rely on firewood and charcoal as their principal source of domestic fuel. Only a combination of all the above factors, will ensure success in any attempt to get households to make the switch to alternative fuels. In the meantime, the best bet is to make the harvesting of forest resources more sustainable.

Electricity does not only extend the day for more work to be done, but also has the potential of helping to reduce the dependence on woodfuels, if and when it is within the means of rural people to use it not only to light their homes, but also to cook.

8.8 Conclusion

The issue of woodfuel use and its link to deforestation is a very complex one. The literature points to a direct correlation between the use of woodfuels and diminishing forests in Ghana and indeed the whole of Sub-Saharan Africa. The factors associated with the use of woodfuels and how these affect the deforestation process, the role of traditional

authorities, the role of traditional gatherers, as well as the perception of rural folks on forest depletion were the central issues that this thesis sought to address. It has shown that there is an urgent need for steps to be taken to protect the forest resources of Ghana, not only for future generations, but for the present generation as well. Since forest resources are being degraded at an alarming rate, it will not be long before Ghana starts to experience a real environmental and energy crisis.

Until there is a shift from using woodfuels to using commercial fuels like electricity and LPG at the household level in Ghana, the only real energy source available to the average household is woodfuel. There is therefore the need for a concerted effort on the part of the private and public sectors to work toward a "real solution" to the dwindling stock problem. The key to protecting Ghana's environment and forests, and at the same time ensuring a continuous supply of wood for energy is to ensure that at the very least what is planted equals or, preferably, exceeds what is harvested. In order to ensure that enough trees are planted to sustain the rate of harvest, intensified education on the importance of developing a tree planting culture among people who have access to land is needed, especially in the rural areas.

The degradation of forests is evident in the areas studied. The situation has not reached a crisis point yet. By a crisis point, the author is referring to the point where the situation is almost irreversible. It has not reached a point where the classic definition of "deforestation" as the complete and total clearance of vegetation can be applied. Nonetheless, deforestation is a process, the beginning of which is, unfortunately, evident in the study areas, and indeed, most of rural Ghana. There is therefore the urgent need for measures to be put in place to prevent the situation from getting worse.

The production of woodfuel has certainly played a very important role in the degradation of forests. There is the need for more research to be done in the area of assessing exactly how much firewood is actually used in Ghana and the rate at which the forests are being degraded. These types of research would help in any meaningful attempt to improve the sustainability of Ghanaian forests.

Finally, there is the need for a concerted multi-sectoral attempt to include environmental factors in future development planning efforts. This has clearly not been the case in the past as is evident in the preamble to Ghana's environmental action plan:

> Attempts over the years to address environmental problems in Ghana have been ad-hoc and largely cosmetic, or at best sector-oriented and therefore limited in scope. ...There is clearly the need for a new direction in trust in national development effort to ensure that plans aimed at improving the standard of the quality of life take due cognisance of environmental considerations (EPC, 1989, p20).

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Appendix 1

Energy and Deforestation in Ghana: A study of woodfuel-deforestation links in rural Ghana.

Questionnaire

The researcher would like to request your involvement in a research project on the relationship between fuelwood use and deforestation and environmetal degradation. The researcher, who is a student at the Wilfrid Laurier University in Waterloo, Ontario, Canada, is undertaking this project as part of his Masters (M.E.S.) programme in Geography.

All answers will remain confidential and you will remain completely anonymous. Your time and effort in helping with this study is sincerely appreciated.

Personal Characteristics

1. Village .....

2. Age of respondent.....

3. Sex of respondent male..... female.....

4. Educational background
a. primary education b. secondary education
c. post-secondary education d. none.
e. other, please specify

5. Primary occupation.....

6. Secondary occupation.....

7. Number of children..... male..... female.....

8. Number of children at home..... male..... female.....

9. Household size.....

Access to Fuelwood

10. How do you get firewood?
a. purchase b. collect from bush
c. both d. other

11. What do you use firewood for?
a. domestic cooking b. commercial cooking
c food processing d Heating
e. lighting f. for sale
g. other, please specify

12. Do you use charcoal?

a. always
b. sometimes
c. no
d. other, please specify

13. Source of charcoal

a. left overs from using firewood
b. make my own charcoal
c. buy
d. other, please specify

14. What proportion of your cooking is done with charcoal?

a. less than 10 per cent
b. about 10 - 20 percent
c. about 25 - 40 percent
d. about half
e. about 75 percent
f. 100 per cent
g. none
h. other

15. Do you stockpile firewood for later use?

a. always
b. sometimes
c. no
d. other, please specify

16. If answer is (a) or (b), why do you stockpile?

a. for later use
b. for sale
c. other, please specify

17. Where do you store the firewood?

a. behing the house
b. in the coumpound
c. Shed/kitchen
d. own room
e. other, please specify

18. If you don't stockpile, why don't you?.....

A. Purchase

19. What quantity (weight) of firewood do you purchase weekly...

20. How much does that cost?.....

21. Was there a time in the past when you collected firewood for use?

a. yes
b. no
c. other, please specify

22. If you collected in ther past, when was the last time you collected?

a. a year ago
b. a couple of years ago
c. 5 tears ago
d. ten years ago
e. other, please specify

23. Why have you stopped?

a. firewood is too far away
b. don't have the time
c. firewood is cheap to buy
d. other, please specify

24. What quantity (weight) of charcoal do you purchase weekly?...

25. How much does that cost?.....

B Collect

26. If you collect firewood in the family, who does the collection?

a. husband
b. wife
c. male children
d. female children
e. other, please specify

27. How often do you collect?

a. daily
b. every two days
c. weekly
d. other, please specify

28. How far do you go to collect firewood?

a. Just behind the house
b. about 100 - 200 metres
c. about 200 -500 metres
d. about a km
e. 2 - 3 km.
f. other, please specify

29. How long does it take you?

a. 30 minutes
b. one hour
c. two hours
d. three hours
e. other, please specify

30. From where do you collect firewood?

a. from the farm
b. bush
c. forest reserve
d. woodlot
e. sacred groves
f. other, please specify

31. Do you make specific trips to collect firewood or do you gather firewood as part of a series of activities?

a. special trips to collect
b. as part of other activities
c. other, please specify

32. If as part of other activities, what are they?

a. going to farm
b. going to fetch water from the river/stream/well
c. other, please specify

33. Have you considered purchasing firewood?

a. yes
b. no

34. If yes, why don't you buy?

a. too expensive
b. have no money
c. firewood is available in the bush
d. other, please specify

35. Ten years ago how did you get firewood?
a. collected from the bush b. purchased
c. both d. other, please specify

36. If different from today, what accounts for the difference?
a. Longer distances b. firewood cheaply today
c. no longer have time d. other, please specify

37. 10 years ago who did firewood collection?
a. husband b. wife
c. children d. other, please specify

38. If there is a change in the responsibility for collection, what accounts for the change? .....

39. Do you spend more time today than 10 years ago in collecting firewood?
a. less b. more
c. same

40. If you spend more time today than previously in firewood collection, how do you accommodate the change (what don't you do now or how do you adjust?)
a. wake up earlier than previously b. come home late
c. stopped doing some other things d. other, please specify

41.If answer to above is (c), what other things have you stopped doing? .....

42. By what means do you transport firewood home?
a. foot b. bicycle
c. tractor d. truck
e. other, please specify

43. If you transport the wood to a selling point by what means do you transport it?
a. foot b. bicycle
c. tractor d. truck
e. other, please specify

C. Both (collect and purchase some)
44. If answer to question 10. is **both,** what proportion do you buy
a. about a quarter b. about half
c. about three-quarters d. other, please specify

45. Why don't you collect all you need from the bush

a. sometimes have no time
b. Sometimes firewood is cheap on the market
c. other, please specify

Sale of firewood

46. Do you sell firewood?

a. yes
b. no.

47. If you **don't** sell, why don't you?

a. no buyers
b. not profitable
c. have no time
d. other, please specify

48. Do you intend to go into the sale of firewood in the future?

a. yes
b. no.
c. don't know
d. not applicable

49. If yes, why?.....

50 . If no, why?.....

51. If you sell firewood now, when did you first start?

a. last year
b. a couple of years ago
c. 5 years ago
d. 10 years ago
e. about 20 years ago
f. other, please specify

52. Why did you decide to start selling firewood?

a. there is ready market for it
b. have no other choice
c. there is more money to be made
d. other, please specify

53. List five species of trees you usually cut for sale (in order of preference)

a .....
b..... .....
c .....
d.....
e .....

54. Do you you cut dead or fresh wood for sale?

a. dead
b. fresh
c. both

55. If you cut fresh wood, why?..... .

56. From what distance do you get your wood?

a. 1 km.
b. 2-3 kms
c. 4-6 kms.
d. other, please specify

57. How long does it take you to get a headload of wood?

a. an hour
b. 2 hours
c. 3 hours
d. 4 hours
e. 5 hours
f. other, please specify

58. Who are your customers?

a. neighbours
b. middlemen from other settlements
c. transport it to bigger towns self
d. artisanal businesses
e. public establishments
f. other, please specify

59. How many people are involved in the firewood business?

a. alone
b. whole family
c. self and hired labour
d. other, please specify

60 . What quantity of firewood do you sell weekly (headloads)

a. 5 headloads
b. 6 - 9 headloads
c. 10 - 15 headloads
d. 15 - 20 headloads
e. over 21 headloads
f. other, please specify

Sale of Charcoal

61. Do you sell charcoal?

a. yes
b. no

62. Source of charcoal sold?

a. burn my own charcoal
b. buy from charcoal burners
c. buy from middlemen
d. other

63. What quantity do you sell weekly?.....

Deforestation and Environmental Degradation

64. Do you think there are more more trees today than 20 years ago?

a. more
b. less
c. same
d. have no idea

65. Do you think there are more or less trees today than 10 years ago?

a. more
b. same
c. same
d. have no idea

66. Comparing 20 and 10 years ago, when do you think there were more trees?

a. the same
b. 20 years ago
c. 10 years ago
d. have no idea

67. What in your opinion is the cause of less or more trees?

a. we cut down too many trees
b. it is natural
c. bushfires
d. human activities
e. other, please specify

68. What, in your opinion, are some of the problems associated with less trees, if any?

a. less rainfall
b. rivers dry up
c. firewood difficult to get
d. none
e. don't know
f. other, please specify

69 . What should be done to remedy the situation of less trees

a. plant more trees
b. use less wood
c. nothing
d. have no idea
e. other, please specify

70 . If there are less trees today, when did you begin to realise that wood was becoming scarce?

a. a few years ago
b. about five years ago
c. about 10 years ago
d. about 15 years ago
e. other, please specify

71. Have you ever taken part in any reforestation project?

a. yes
b. no

72. If yes, what were some of the problems you encountered?.....
.....

73. Do you think a time would come when there would be no more wood for energy?

a. yes
b. no
c. don't know
d. other, please specify

74. What would you do when that happens?

a. shift to other sources of energy
b. don't know
c. other, please specify

75. Why havn't you tried using gas cookers and other alternative energy sources?

a. not available
b. too expensive
c. other, please apecify

76. If alternative sources of energy (like gas cookers and electric stoves) are available at affordable prices, would you consider using them?

a. yes
b. no
c. don't know
d. other, please specify

77. Do you have any forest reserves in your area?
a. yes b. no
c. no idea

78. If yes, do you know why it was created?
a. yes b. no

79. If yes, what are they?
a. protect from being destroyed b. to prevent us from getting the wood we want
c. protect trees for timber industry d. other, please specify

80. If there is a forest reserve near your village, are they any rules and regulation regarding this reserve?
a. yes b. no
c. don't know

81. If yes, what are they?.....

82. Who set the rules and regulations?
a. central government b. district assemblies
c. traditional chiefs d. other, please specify
e. don't know

83. Are the rules and regulations fair?
a. yes b. no
c. don't know

84. If the rules are not fair, why are they not?.....
.....

85. Are these rules enforced?
a. yes b. no
c. don't know

86. Do you think these rules and regulations should be changed?
a. yes b. no
c. don't know

87. If yes, what rules should be added?.....
.....

88. And what rules should be removed?.....
.....

89. Types of Fuel used in the household

Type of energy	household. cooking	Food proces	Heating	Light.	Other
F.wood					
C.coal					
Keros.					
Elect.					
L.P.G					
Other source					

90. How much Kerosene do you use in a week (measured in coke bottles)

a. 1 b. 2
c. 3 d. 4
e. 5 f. other, please specify

91. Why is kerosene a preferred energy for lighting?

a. it is cheaper b. it is efficient
c. availability d. other, please specify

92. Why is firewood a preferred energy source for cooking?

a. it is cheaper b. availability
c. it is efficient d. other, please specify

93. Who does the following in the family (male or female)

Activity	Male	Female
Firewood collection		
Water collection		
Crop establishment		
Crop weeding		
Crop harvesting		
Internal marketing		
Health		
Grinding mill		
Trips to market		
External marketing		

Thank you very much.